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The Horseless Age

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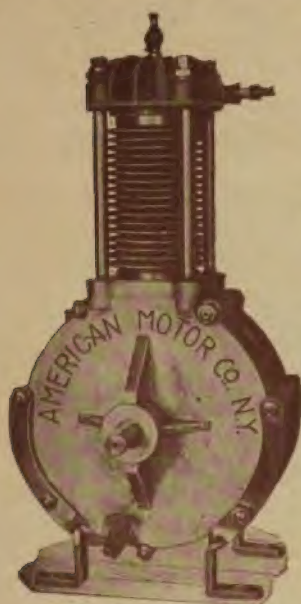
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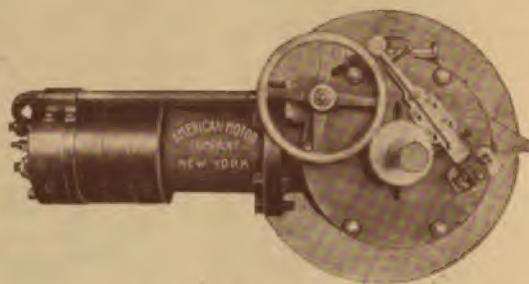
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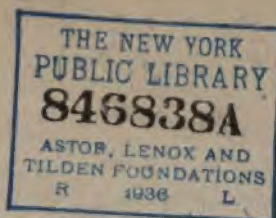
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THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. IV.

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E. P. INGERSOLL, Editor and Proprietor.

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Shall Vehicle Motormen be Licensed?

At last our authorities are turning their attention critically to the motor vehicle to see what sort of a creature it is and how they can best rebuke the bumptious new-fangled invention that has dared to thrust itself into our modern civilization without asking their consent, for the powers that be regard every radical improvement much as a grandsire does a prankish grandson, whom he feels it his duty to soundly castigate at every opportunity. This strange machine that everybody has been talking about is now actually in our streets in daily increasing numbers, and something must be done to determine its status and limit its usefulness or law-makers would have idle time upon their hands. Besides, many people who rode in the wonderful "One Hoss Shay," and haven't mustered up courage enough since to take a more modern conveyance, picture the new machine as a juggernaut, liable at any time to escape the hands of the motor-man and run amuck in the streets, overthrowing pedestrians

and demolishing horse vehicles. Space writers in the daily press have fostered these fears by accounts of imaginary runaways of motor vehicles, the cue for which is seen to be taken directly from the horse runaways with which we are all too familiar. Deceived by these misrepresentations, and perhaps influenced to some extent by the cries of the "vested interests" that wish to be saved from the consequences of their ignorance and obstinacy, our legislators have put on their spectacles and are prepared to scrutinize the newcomer with no friendly eye. In the New York Assembly at Albany they are doing this now. A bill has been introduced by Assemblyman Henry W. Hill, requiring every operator of a motor vehicle to take out a license from properly constituted authorities. The following is the text of the bill:

An act providing for the licensing of operators, motormen and drivers of cabs, trucks or other vehicles propelled by any power other than animal power in cities of the first class.

The people of the State of New York, represented in the Senate and Assembly, do enact as follows:

Section 1. After the first day of July, eighteen hundred and ninety-nine, no person shall act as the operator, motorman or driver of any cab, truck or other vehicle propelled by any power other than animal power upon the streets or public places of any city of the first class without obtaining a license, as provided by this act.

Section 2. Within twenty days after this act becomes a law the mayor of every city of the first class shall appoint a competent person to act as examiner of persons desiring to act as operators, motormen or drivers of such cabs, trucks or other vehicles. Such examiner shall not receive any salary or compensation from the city, but may apply to his own use the fees collected pursuant to this act.

Section 3. He shall at least once in each month, at a time and place to be prescribed by him, conduct an examination of applicants for licenses to act as operators, motormen or drivers of such cabs, trucks or other vehicles. Such examination shall include the practical operation of the kind of cab, truck or other vehicle for which a license is desired. Such examination shall also include an investigation of the habits and physical qualifications of the applicants. Any person desiring to be so examined shall, at least five days before the date of the examination, file with the examiner a written application, stating his name, experience and the character of the vehicle for which a license is desired. He shall also, upon making such application, pay to the examiner a fee of \$1.

Section 4. Such examiner shall issue to each person who shall pass a satisfactory examination a license, stating the name of such person and the character of cab, truck or other vehicle for which he is authorized to act as operator, motorman or driver. Any such license may thereafter be revoked by such examiner, upon proof to his satisfaction that the

licensee is, for any reason, unfit to act as operator, motorman or driver of such cab, truck or other vehicle.

Section 5. Any person who, after July first, eighteen hundred and ninety-nine, shall act as operator, motorman or driver of any cab, truck or other vehicle propelled by any power other than animal power upon the streets or public places of any city of the first class, without a license issued pursuant to this act and unrevoked, shall be guilty of a misdemeanor.

Section 6. This act shall not apply to operators, motormen or engineers on the cars or engines of street surface, elevated or steam railroads.

Section 7. This act shall take effect immediately.

The arguments advanced by the advocates of this bill are of the old kind. The motor vehicle is a machine, they say, and the one who has charge of it should be made to take out a license, like an engineer. There is a wide difference between the motor vehicles at present in use in our streets and a steam engine. An engineer is required to have a license, not because he is in charge of a machine, but because he has the care of a steam boiler, which if not properly attended to, may explode and destroy life and property. The guiding of a motor vehicle in the streets no more calls for an engineer's experience than does the driving of a horse or the manipulation of a trolley motor.

If we dismiss from our minds the false idea that the motor vehicle is in any way to be compared to an ordinary steam engine, and hence is not a source of danger from explosion, we come next to the question of control, and here we find a prolific source of error in the popular mind. The manoeuvres of the motor vehicle are so much more rapid than those of the horse vehicle that the public fancy the thing is continually "getting away" from the motorman, when, as a matter of fact, it is all the time under the most perfect control. They know that a horse vehicle performing such evolutions and making such speeds in city streets would be beyond the control of the driver, and, knowing nothing of the superior control of the motor vehicle they assume that the motor is running amuck too. The point to be dwelt on in combatting this error is that the motor vehicle is far easier controlled than the horse, and that speeds and manoeuvres impossible for the quadruped are easily managed by the motor. Our assemblymen can satisfy themselves of the truth of this assertion by actual study of the machines, and they should not undertake to legislate for them until they have made this study.

If it can be conclusively shown that the motor vehicle is not a dangerous machine, and that it is much easier controlled than the horse, why is special legislation needed to govern its use in our streets? Trolley cars and horse vehicles in charge of unlicensed operators are in full swing in our thoroughfares. Accidents occasionally occur to both, yet no one suggests that drivers and trolley motormen should be licensed. The general laws of the road, presumably known to all, are considered sufficient in these cases. Why are they not sufficient to cover the use of motors too? The violator of the laws of the road suffers the penalty. If he is an employee of a firm or corporation, his employers are held re-

sponsible for damages. Street accidents are a cause of delay and loss to all concerned, and all wish to avoid them. Employers of truckmen, drivers and motormen find it to their interest to secure careful and competent men and instruct them fully in the duties of their position. How will these conditions be changed by the entrance of the motor vehicle? Will not prudence dictate that competent men be selected to handle the motors, just as it now does in the choice of drivers and trolley motormen? As to the qualifications necessary, it is merely a matter of manual dexterity, acquired by practice, and necessitating a quick eye and a cool head. Some men lack the two last-named requisites and are discarded in the preliminary examinations. The Electric Vehicle Co., of New York, and the electric cab companies of Paris, both have rigid systems of testing and training all their employees before entrusting them with cabs. It is the ordinary, every-day rule of all business enterprises which necessitate the operation of vehicles of any kind, and it would be an intolerable abuse for the law to step in and undertake to select a private firm's employees, when this can be much better done by the employer himself.

In France, the regulations governing the use of motor vehicles are characteristically minute and voluminous. Among the provisions recently added to these regulations is one to the effect that motor vehicles shall not frighten horses nor give off disagreeable odors. Vehicles weighing more than 550 pounds are required to reverse. Every purchaser of a motor vehicle is supposed to receive from the manufacturer a complete description of it; which he must submit to the prefect of the department in which he lives, accompanied by his name and address. If everything is found satisfactory, he receives a permit to run his vehicle throughout France.

Only in case of properly organized races, is it allowable to exceed the legal limit of eighteen miles an hour in the country.

Every conductor of a motor vehicle must possess a license granted by the prefect of police, on the approval of the engineering department, and in important centers where the engineers alone cannot examine all the vehicles presented, inspectors are appointed. A special certificate is required for conductors of motorcycles weighing less than 300 pounds.

If a tractor or wagon train is to be used full details of the route, wagons, etc. must be submitted. Each wagon must be provided with suitable brakes and a sufficient number of employees must accompany the train. If vehicles are intended for public service the stands will be selected by the prefect.

These regulations furnish a good example of the espionage or surveillance of the government over the affairs of the individual in France. The citizen is given no discretion. Hard and fast rules are laid down for his guidance by the State, and he must obey them, whether they are exactly suited to all the conditions or not. In England and America, however, a different theory prevails. Within certain broad lines the citizen is allowed to decide for himself, without the meddlesome in-

terference of inspectors, commissaries, and a horde of officials, great and small, to hamper his movements and do his thinking for him.

The proposed bill to license motormen in this country is an imitative measure from French precedents. It is false to our institutions, detrimental to the citizen, whose freedom it curtails, and an impediment to a most promising industry.

The most that the law should do is to fix the limit of speed at which motor vehicles can be run in cities, a measure justified by the thoughtless conduct of some motor vehicle enthusiasts, and by the fact that the motor vehicle is so much swifter than the horse and so far superior in control. To exceed this simple provision in the attempt to regulate motor vehicle traffic, would be un-American and unwise. In fact, it would be nugatory, for the motor vehicle is coming into general use so quickly and so overwhelmingly, and its advantages over the horse will soon be so clearly demonstrated to all, that an act like that quoted above would become a dead letter almost before the ink was dry. Legislators themselves would see its inconsistency.

“Showing Off.”

The English journals are full of reports of a fatal accident which overtook a motor carriage at Harrow, the other day, resulting in the death of two men and the injury of four others. Five persons went out riding in a Daimler carriage, in charge of an experienced employee of the company. This employee wished to “show off” the carriage to his passengers, and boasted that he could stop it on a down grade so suddenly that they would all be hurled to the road. He proceeded to verify his boast with a literal precision he himself had not bargained for. He applied the brakes too suddenly while going at high speed down hill, the result being that a wheel collapsed, letting the vehicle down and throwing all the occupants out. The motorman and one of the passengers were killed. Four others were more or less injured.

Technical journals, commenting on the accident, blame the faulty construction of the wheels, and have light censure for foolhardy motormen, who “show off” themselves and their vehicles at the risk of the lives of those entrusted to their care, as well as the lives of others on the highway, and who undertake speeds wholly outlawed on the public highway. They are of the same class as those excruciatingly funny men who rock row boats to frighten women and children, and occasionally drown a few of them to gratify their love of sport. Motor vehicle manufacturers would do better to employ men of discretion, who will be content with the rational use of a vehicle, and will not “show off” with such shocking results.

Special Machinery and Tools.

The rapid growth of the motor vehicle industry is creating a splendid demand for machinery and machine tools of various

kinds. Quite a number of tools and machines are already being adapted to the needs of the motor vehicle manufacturer. Others will be brought out in the near future in response to the increasing demand.

In our weekly issues we will print a series of articles in the nature of an illustrated catalogue of machines and tools that are specially adapted to the needs of the manufacturer of motor vehicles—machines for making gears, hubs, wire spokes, steel rims, boring cylinders of gas or steam engines, etc.

Manufacturers who are making any tool or machine that is applicable to these purposes are invited to send us a cut (photo or drawing) and description, for publication in the above department, taking care in the description to explain fully its utility in this new field.

To those who are fitting up factories for the production of motor vehicles, an opportunity is presented not only of utilizing the very latest and most improved designs of the machine tool builders, but of originating special attachments and tools for the more accurate and economical performance of their work. It has been the custom to postpone this specialization of machinery until the later stages of industrial development have been reached and competition compels a more careful study of the cost of production, but the wisest course is to introduce it at the start, and extend it as experience shows the way. To stimulate invention along this line the above department has been opened.

Medicine for the Speculators.

The speculators of New York and Philadelphia have been playing football with motor vehicle stocks the past few weeks. An enthusiasm akin to madness has apparently seized the investing public, and the promoters of multi-million dollar companies have no difficulty in coaxing the dollars from the silly lambs on wildcat rumors and stories more extravagant than the tales of the Arabian Nights. What Wall Street needs is a dose of thermodynamics. The same heroic treatment should also be taken by the investing public. A liberal dose of this much-needed medicine is contained in this issue of THE HORSELESS AGE. Similar doses will follow. If it is taken good results will follow. Those who refuse to take it must take—the consequences.

Brooklyn Parks Thrown Open.

Electric vehicles now have the freedom of Prospect Park, Brooklyn, N. Y., precisely the same as horse vehicles. For a time a permit was required by the authorities, but a little experience with the new conveyance proved to the custodians of the parks that horses are taking their new competitors more philosophically than they anticipated, and all restrictions were removed. The action of the Brooklyn officials will undoubtedly have the effect of unlocking other parks to the motor carriage.

Some Thermo-Dynamics of Vehicle Motors.

BY HUDSON MAXIM.

The writer was recently called upon as an expert to give an opinion on the relative efficiencies and practical values of various motor fluids in their application to vehicle propulsion; and some of the data hunted up and some of the calculations made in connection with the work, may be of interest to readers of THE HORSELESS AGE.

The principal motor fluids used expansively are compressed air, carbon di-oxide, steam, and products of the combustion of hydro-carbons in air.

With regard to steam and compressed air, all necessary data are readily available in current engineering publications, upon which one may base calculations and depend upon them to work out fairly well in practice; but with regard to ammonia there is not so much reliable data, and the claims for internal combustion engines differ very much, while there is very little indeed published as to the actual practical working efficiency of carbon di-oxide.

The writer has, in the following calculations, sought to show only the relative theoretical efficiencies of the various motor fluids mentioned, in terms of foot pounds, based upon the specific heats of the gases, or on their ratios of expansion without regard to specific heats.

No account has been taken of the efficiency of the motor in which the gases are to be used, and the work has been calculated without regard to back pressure, except atmospheric pressure, the end sought being simply to arrive at their relative theoretical work in foot pounds, by expansion from given pressures and temperatures to one atmosphere of pressure.

The capacity of gases for doing work is in direct proportion to the quantity of heat which a given volume is capable of absorbing and again giving out as work by the action of pressure in displacing an object of resistance or imparting momentum to a body.

The atoms and molecules of which a gas is composed are in a state of constant vibration corresponding with the temperature of the gas. We have in the constitution of matter the grouping of the atoms or ultimate particles to form molecules; the ultimate atoms are probably alike in all bodies and the different elements are formed by difference in numbers of ultimate atoms in molecules and their grouping or relative positions with respect to one another, resulting in different orders and velocities of vibrations. If a gas be heated the paths through which the atoms and molecules vibrate are lengthened owing to the increased velocity of the molecules, and when a gas is cooled the molecular paths are shortened, and if the cooling be continued sufficiently the character of the body is changed to a liquid and from a liquid to a solid, on account of the nearer approach to one another of the constituent molecular particles of the body.

If a given volume of gas be confined in a closed vessel, so that when heated its volume will remain constant, it will be found that the same quantity of heat will be required to produce a given amount of pressure whatever simple gas may

be employed, and we learn that all simple gases have approximately the same thermal capacity per unit of volume when compared at the same pressure and temperature. Oxygen, which weighs sixteen times as much as hydrogen for the same volume, will require only the same quantity of heat to cause it to exert equal pressure upon the walls of the container. The reason for this phenomenon may be explained in the following manner: It is the impact of the gas molecules upon the walls of their container which produces the pressure. A given quantity of heat absorbed by the oxygen will impart to its molecules a velocity, say, one-fourth as great as the same quantity of heat absorbed by the hydrogen will impart to its molecular particles, and therefore, the hydrogen particles, although weighing sixteen times less, but traveling at a velocity four times as great, will exert upon the walls of their container a force equal to the slower moving oxygen molecules.

To illustrate, if a projectile weighing one ounce be thrown from a gun with a velocity sufficient to give it a muzzle energy to cause it to strike a blow of one foot ton, approximately the same energy would be consumed in giving to a one pound projectile a velocity one-fourth as great, and which velocity would also cause the projectile to strike a blow of one foot ton. Similarly, with the gas molecules of hydrogen and of oxygen, an equal quantity of heat imparts a higher velocity to the lighter body, a lower velocity to the heavier body, and to both an equal striking force.

The best thing that the writer has seen on the mechanical equivalent of heat is to be found in "Heat a Mode of Motion," by Prof. Tyndall, published by D. Appleton & Co., New York, and the following quotations are made from pages 124 to 129:

"Suppose a quantity of air to be contained in a very tall cylinder, A B (Fig. 1), the transverse section of which is one square inch in area. Let the top A of the cylinder be open to the air, and let P be a piston, which can move airtight and without friction up or down in the cylinder. For reasons to be explained immediately, I will suppose the piston to weigh two pounds one ounce. At the commencement of the experiment let the piston be at the middle point P of the cylinder, and let the distance from B to P be 273 inches—the air underneath the piston being at a temperature of 0° C. Then, on heating the air from 0° to 1° C., the piston . . . will rise one inch, and stand at 274 inches above the bottom. If the temperature be raised two degrees, it will stand at 275; if raised three degrees, it will stand at 276; if raised ten degrees it will stand at 283; if 100 degrees, it will stand at 373 inches above the bottom. Finally, if the temperature were raised to 273° C., it is quite manifest that 273 inches would be added to the height of the column, or, in other words, that by heating the air to 273° C., its volume would be doubled.

"In this experiment, the expanding air executes work. In lifting the piston from P to A it overcomes the downward pressure of the atmosphere which amounts to 15 lbs, and also the weight of the piston, which is 2 lbs. 1 oz. The work done by the air is therefore equivalent to raising a weight of 17 lbs. 1 oz., or 273 ounces, to a height of 273 inches. The same amount of work could be accomplished if the atmosphere above P were entirely abolished, a frictionless piston weighing 17 lbs. 1 oz. being placed at P.

"Let us now alter our mode of experiment, and instead of allowing the air to expand, let us oppose its expansion by augmenting the pressure upon it. In other words, let us keep

its volume constant while it is being heated. Suppose, as before, the initial temperature of the gas to be 0° C., the pressure upon it, including the weight of the piston P, being as formerly 273 ounces. Let us warm the gas from 0° C. to 1° C.; what weight must we add at P in order to keep its volume constant? Exactly one ounce. But we have supposed the gas, at the commencement, to be under a pressure of 273 ounces, and the pressure it sustains is the measure of its elastic force; hence, by being heated one degree, the elastic force of the gas has augmented by $1/273$ of what it was at 0° . If we warm it 2° , two ounces must be added to keep its volume constant; if 3° , three ounces must be added. And if we raise its temperature 273° , we shall have to add 273 ounces, or, in other words, we must double the original pressure to keep the volume constant.

"It is simply for the sake of clearness, and to avoid fractions, that I have supposed the air to be under the original pressure of 273 ounces. For as long as the air behaves as a sensibly perfect gas, no matter what the pressure may be, the addition of 1° C., to its temperature produces an augmentation of $1/273$ of the elastic force which the air possesses at 0° C., while by raising its temperature 273° without expansion, its elastic force is doubled. Let us now compare this experiment with the last one. There we heated a certain amount of gas from 0° to 273° C., and doubled its volume by so do-

sumed in lifting the weight. . . . Using accurate numbers, the quantity of heat applied when the pressure is constant, is to the quantity applied when the volume is constant, as

$$1.421 : 1.$$

"The quantity of work here executed and the quantity of heat expended are both perfectly definite; hence the possibility of comparing them together, and of expressing the one in terms of the other.....

"Let C (Fig. 2), be a cylindrical vessel with a base one square foot in area. Let P P mark the upper surface of a cubic foot of air at a temperature of 0° C. or 32° Fahr. The height A P will then be one foot. Let the air be heated till its volume is doubled. To effect this it must, as before explained, be raised 273° C., or 490° F. in temperature, and when expanded its upper surface will stand P' P' one foot above its initial position. But in rising from P P to P' P' it has forced back the atmosphere, which exerts a pressure of 15 lbs. on every square inch of its upper surface, the area of which is 144 square inches. In other words, it has lifted a weight of $144 \times 15 = 2,160$ lbs. to a height of one foot.

"The usual way of expressing numerically a definite quantity of heat is to state the number of pounds of water which it could raise 1° in temperature. The 'unit of heat' is the quantity which would raise 1 lb. of water 1° . My aim now is to express in such units the quantity of heat applied in the foregoing experiment to the performance of work. Comparing equal weights of air and water, the quantity of heat required to raise the temperature of the former one degree would raise that of the latter a little less than a quarter of a degree. Employing the old phraseology, the 'capacity' of water for heat being 1, the capacity of air would be a little less than $1/4$. Strictly speaking, it would be 0.24. Now the weight of our cubic foot of air is 1.29 oz.; hence the quantity of heat required to raise 1.29 oz. of air 490° Fahr. would raise a little less than one-fourth of that weight of water 490° . The exact quantity of water equivalent to our 1.29 oz. of air is $1.29 \times 0.24 = 0.31$ oz.

"But 0.31 oz. of water, heated to 490° is equivalent to 152 ozs. or $9\frac{1}{2}$ lbs. heated 18 . Thus the heat imparted to our cubic foot of air, in order to double its volume, and enable it to lift a weight of 2,160 lbs. one foot high, would be competent to raise $9\frac{1}{2}$ lbs. of water one degree in temperature.

"The air has here been heated under the constant pressure of the atmosphere, and we have learned that the quantity of heat expended on air under constant pressure is to that expended on the same air at constant volume as 1.421 : 1; hence we have the statement:

$$1.421 : 1 = 9.5 \text{ lbs.} : 6.7 \text{ lbs.},$$

which shows that the quantity of heat necessary to augment the temperature of our cubic foot of air, at constant volume, 490° , would raise the temperature of 6.7 lbs. of water 1° F.

"Deducting 6.7 lbs. from 9.5 lbs., we find that the excess of heat imparted to the air, in the case where it is permitted to expand, is competent to raise 2.8 lbs. of water 1° in temperature.

"As explained already, this excess is employed to lift a weight of 2,160 lbs. one foot high. Dividing 2,160 by 2.8, we find that a quantity of heat sufficient to raise 1 lb. of water 1° Fahr. in temperature, is competent to raise a weight of 771.4 lbs. a foot high. If the centigrade scale be used the equivalent is 1390 foot-pounds."

A gas in expanding from a higher to a lower pressure without doing work, remains unaltered in temperature. To illustrate this (Fig. 3) let us take a chamber A and a chamber

Fig. 1.

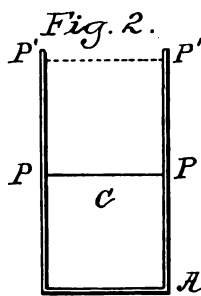
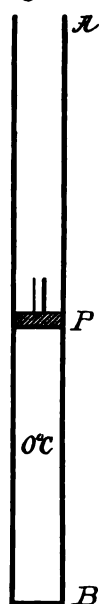
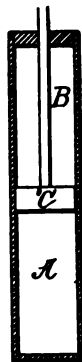


Fig. 3.



ing, the double volume being attained by lifting a weight of 273 ounces through a height of 273 inches. Here we heat the same amount of gas from 0° to 273° , but we do not permit it to lift any weight. The quantity of matter heated in both cases is the same; the temperature to which it is heated is the same; but are the absolute quantities of heat imparted in both cases the same? By no means. Supposing that to raise the temperature of the air, whose volume is kept constant, 273° , the heat of 10 grains of burning wax is necessary; then to raise the temperature of the air, whose pressure is kept constant, an equal number of degrees, would require the consumption of $14\frac{1}{4}$ grains of the same combustible matter, and the heat of the additional $4\frac{1}{4}$ grains of wax is entirely con-

B, each side of the piston-head C; the chamber A being filled with gas under pressure, while the space C is a vacuum. Now let us conceive the piston-head C to be instantly annihilated. instead of being forced forward by the pressure of the gas in A; the gas in A would rush in with great velocity to fill the vacuum C, each molecule serving to accelerate the velocity of all the other molecules ahead of it, and losing in heat the exact equivalent of the work done; the body of gas impacting on the forward end of the chamber C, and the molecules impacting upon one another, would develop heat exactly equal to that absorbed in expanding the gas, the rear portion of the body of gas being slightly cooled, and the forward portion slightly heated, the loss of heat at the one end exactly balancing the gain in heat at the other; but the heat would be quickly diffused throughout the whole body of gas, restoring it to the original temperature.

The efficiency of an engine may be measured by the ratio of the heat converted into work to the whole amount of heat in the motor fluid entering the engine. If we make no account of loss of heat by radiation through the walls of the apparatus, the total heat of the motor fluid entering the engine, less the total heat of the same in the exhaust, will represent the amount of heat converted into work.

To understand how heat is converted into work, or is abstracted from a gas in forcing along the piston of an engine, let us consider the fact that the heat converted into momentum of the engine piston is not as with a gas, simply propelling itself (Fig. 3), given back again to the gas upon reaching the limit of the stroke.

When compressed air is expanded to do work, if we do not take into account the absorption of heat by the walls of its container and the surrounding air, the heat converted is abstracted from the expanding air itself, which results in great lowering of its temperature and its efficiency. If external heat be applied and the temperature of the air raised to 500 degrees Fahr. on its emission from the reservoir, and before expanding, the theoretical work which one pound of air would be capable of doing from an initial pressure of about ninety atmospheres is 129,798 foot-pounds, as against more than 200,000 foot-pounds of work which one pound of steam would be capable of doing at the same temperature and expanding from a pressure only about half as great.

With respect to liquids which give a high vapor tension at normal temperatures, the fact must be taken into account that a liquid of such character, although it may require a strong container to hold it in a liquid state (examples of which liquids are carbonic acid, liquid ammonia and liquid air), does not evidence, from the fact of its high pressure, corresponding capacity for doing work.

If we take carbon di-oxide as an example and eliminate the small quantity of heat absorbed from the atmosphere, then such a fluid is capable of doing no more work than is represented by heat which may be extracted from the liquid body to supply the heat of its evaporation and the tension of its gas, which may be utilized in an engine. It is for this reason that there have been so many disappointments in working with carbon di-oxide, the abstraction of heat going on simply long enough to freeze the remaining liquid. If external heat be applied to supply the latent heat of carbon di-oxide, and to superheat the gas before entering the engine, then the efficiency of this fluid, if compared weight for weight with other fluids, will vary with its increasing volume from a liquid to a gas, under a given temperature. Now, as carbon di-oxide gas, volume for volume, is considerably heavier than steam,

at the same temperature and pressure, while the liquid has a specific gravity slightly less than water, the inference is forced upon us that a pound of this liquid is not capable of doing as many foot-pounds of work as a pound of water even though the carbonic acid be admitted to the engine under an initial pressure of 750 lbs. to the square inch, and allowed full expansion.

This *a priori* conclusion appears to be borne out by the following calculations:

Let us, for argument's sake, imagine one pound of carbonic acid to be evaporated and utilized to do work in the following manner: The vapor tension above the liquid is about 767 lbs. to the square inch. Let us allow the be evaporated at this temperature, supplying just heat to the reservoir to furnish the latent heat of evaporation; then superheat the free gas to a temperature of 50 passing it through a coil, while maintaining it at that pressure. Let us now imagine that the gas, while doing to do work be supplied with external heat to convert that converted into work and also let us give the benefit of full expansion down to atmospheric pressure we shall still find that it will take more than twelve of the liquid to develop one horse power hour. The termination may be arrived at as follows, based on the pressure during isothermal expansion:

Volume 1 lb. at initial pressure, .3026 cu. ft.

Volume 1 lb. at final pressure, 15.8 cu. ft.

R. (Ratio of expansion) is 52.2, Hyp.Log. = 3.954

$(1 + \text{Hyp.Log. } R)$

Pm. (Average pressure) = $P \frac{R}{R-1} = 7$

72.729 lbs (Pm.) x 144 (sq. ins.) = 10,472.976 lbs. p

10,472.976 x L. (length of stroke) 15.5 ft. = 162,331 in 1 lb. of CO₂.

33,000 x 60 = 1,980,000 ft. lbs. minutes in 1 H.P. hour.

1,980,000 divided by 162,331 = 12.19 lbs. of CO₂ needed per 1 H.P. hour.

PRIMARY DATA EMPLOYED IN THE CALCULATIONS.

Sp Gr. Liquid CO₂ 32° F. = .9470 Roscoe & Schorlemmer, 1895, Vol. 1, p. 720.

Sp. Gr. Liquid NH₃ 32° F. = .6234 Roscoe & Schorlemmer, 1895, Vol. 1, p. 458.

Air at atm. p. 32° F. = 1.773, Roscoe & Schorlemmer, 1895, Vol. 1, p. 527.

Pressure Liquid CO₂ at 32° F. = 35.4 atm. Watts Dict. Chem. Vol 1, 1888, p. 691.

Pressure Liquid NH₃ at 32° F. = 4.188 atm. (3183.34 m.m) Ibid. Vol. 1, 1888, p. 197.

Latent Heat Liquid CO₂ atm. pr. = 298, Haswell's Mechanics' & Engineers' Pocket Book, 1884, p. 500.

Latent Heat Liquid NH₃ atm. pr. = 860, Haswell's Mechanics' & Engineers' Pocket Book, 1884, p. 500.

Sp. Gr. Air at 1314.7 lbs. = .1157 Calculated from Boyle's Law.

Pressure Air at 1314.7 lbs. = 89.439 atms.

Weight of 1 cu. ft. Liquid CO₂ = 59.1875 lbs. at 32° F.

Weight of 1 cu. ft. Liquid NH₃ = 38.0625 lbs. at 32° F.

Weight of 1 cu. ft. of Air = 7.23125 lbs. at (89.435 atms.) at 32° F.

Sp. Gr. Liquid CO₂ 59° F. = .88 Calculated from Roscoe & Schorlemmer, Vol. 1, p. 720.

Sp. Gr. Liquid NH₃ 60° F. = .6043 Calculated from Roscoe & Schorlemmer, Vol. 1, p. 458.

Sp. Gr. Air 59° F. = .1097 at 1314.7 lbs. pressure, calculated from Boyle's Law and Law of Charles and Gay-Lussac.

Pressure Liquid CO₂ F. = 52.2 atm. Watts Dict. Chem. Vol. 1. 1888, p. 691.

Pressure Liquid NH₃ 60° F. = 6.9 atm. Roscoe & Schorlemmer, Vol 1, p. 458.

Weight of 1 cu. ft. Liquid CO₂ at 59° F. = 55 lbs.

Weight of 1 cu. ft. Liquid NH₃ at 60° F. = 37.76875 lbs.

Weight of 1 cu. ft. of Air at 59° F. = 6.8565 lbs. (89.435 atms.)

F SPECIFIC HEATS BY WEIGHT.

$$\frac{Y-1}{Y} K.$$

Air Constant Pressure... .2377.

Air Constant Volume... .1688 .29 183.45.

NH₃ Constant Pressure... .5080.

NH₃ Constant Volume... .3911 .2301 392.176.

CO₂ Constant Pressure... .2164.

CO₂ Constant Volume... .1714 .2079 167.0608.

Steam Constant Pressure .4750.

Steam Constant Volume... .3700 .221 366.7.

OR CALCULATING WORK BASED ON SPECIFIC HEATS.

one pound of gas expanded adiabatically may be formula

$$W = K. (T - T')$$

specific heat of a gas at constant pressure expands, T the absolute temperature before

T' the final temperature after expanding.

be 461° + 400° (when that temperature is em-

F., and T' may be found according to the

formula,

$$\frac{(P)}{P'} \frac{Y-1}{Y} = \frac{T}{T'}$$

Where $\frac{P}{P'}$ is the ratio of the initial and final pressures and

Y the ratio between the specific heats at constant pressure and constant volumes. These formulas are obtained from Clarke's Manual of Rules, Tables and Data, 1894, from the article on "Work of Dry Air or other Gas Compressed or Expanded," pages 989, 901, 904, etc.

The values K and $\frac{Y-1}{Y}$ are given for each gas in the preceding Table, and have been calculated from the specific heats also given in the Table, which were taken from Clarke's Manual, page 363.

CALCULATIONS OF WORK BASED ON SPECIFIC HEATS.

WORK DONE BY ONE POUND AND BY ONE CUBIC FOOT (7.23 LBS.) OF AIR AT 32° F. HEATED TO 400° F. AND EXPANDED FROM 89.435 ATMOSPHERES TO ONE ATMOSPHERE.

$$T - T' = 627.08 \text{ (Calculated.)}$$

183.45 (K) × 627.08 (T - T') = 115,037.826 (ft. lbs., 1 lb. of Air.)

7.23 (lbs.) × 115,037.826 = 831,723 (ft. lbs.) 1 cu. ft. of Air.

WORK DONE BY ONE POUND AND BY ONE CUBIC FOOT (59.1875 LBS.) OF LIQUID CARBONIC ACID AT 32° HEATED TO 400° F. AND EXPANDED FROM 35.4 ATMOSPHERES TO ONE ATMOSPHERE.

75.316.02 × 59.1875 (lbs.) = 4,457.767 ft. lbs. in 1 cu. ft.

$$T - T' \text{ (Calculated)} = 450.83.$$

167.0608 (K) × 450.83 (T - T') = 75,316.02 (ft. lbs. 1 lb. of CO₂.)

75,316.02 × 59.1875 (lbs.) = 4,457.767 ft. lbs. in 1 cu. ft. Liquid CO₂.

WORK DONE BY ONE POUND AND BY ONE CUBIC FOOT (38.9625 LBS.) OF LIQUID AMMONIA AT 32° F. HEATED TO 400° F. AND EXPANDED FROM 4.188 ATMOSPHERES TO ONE ATMOSPHERE.

$$T - T' \text{ (Calculated)} = 241.731.$$

392.176 (K) × 241.731 (T - T') = 94,801.096 ft. lbs. in 1 lb. Liquid NH₃.

94,801.096 × 38.9625 (lbs.) = 3,693,688 ft. lbs. in 1 cu. ft. Liquid NH₃.

WORK DONE BY ONE POUND AND BY ONE CUBIC FOOT OF WATER AT 32° CONVERTED INTO STEAM AND EXPANDED FROM 16.8 ATMS. (246.9 LBS. AND 400° F.) TO ONE ATMOSPHERE.

$$T - T' \text{ (Calculated)} = 399.54.$$

366.7 (K) × 399.54 (T - T') = 146,511.318 ft. lbs. in 1 lb. of water.

146,511.318 × 62.5 (lbs.) = 9,156,957 ft. lbs. in 1 cu. ft. of water.

WORK DONE BY ONE POUND AND BY ONE CUBIC FOOT OF AIR AT 59° F. HEATED TO 500° F. AND EXPANDED FROM 89.435 ATMOSPHERES TO ONE ATMOSPHERE.

$$T - T' \text{ (Calculated)} = 699.91.$$

185.45 (K) × 699.91 (T - T') = 129,798.3 ft. lbs. in 1 lb. Air.

129,798.3 × 6.856 (lbs.) = 889,897 ft. lbs. in 1 cu. ft. Air.

WORK DONE BY ONE POUND AND BY ONE CUBIC FOOT (55 LBS.) OF LIQUID CARBONIC ACID, AT 59° F. HEATED TO 500° F. AND EXPANDED FROM 52.2 ATMOSPHERES TO ONE ATMOSPHERE.

$$T - T' \text{ (Calculated)} = 538.7.$$

167.0608 (K) × 538.7 (T - T') = 89,995.65 ft. lbs. in 1 lb. CO₂.

89,995.65 × 55 (lbs.) = 4,949,760.75 ft. lbs. in 1 cu. ft. CO₂.

WORK DONE BY ONE POUND AND BY ONE CUBIC FOOT (37.77 LBS.) OF LIQUID AMMONIA, AT 60° F. HEATED TO 500° F. AND EXPANDED FROM 6.9 ATMOSPHERES TO ONE ATMOSPHERE.

$$T - T' \text{ (Calculated)} = 344.825.$$

392.176 (K) × 344.825 (T - T') = 135,232.089 ft. lbs. in 1 lb. NH₃.

135,232.089 × 37.77 (lbs.) = 5,107,716 ft. lbs. in 1 cu. ft. NH₃.

WORK DONE BY ONE POUND AND BY ONE CUBIC FOOT (62.5 LBS.) OF WATER AT 59° CONVERTED INTO STEAM AT 500° F. AND EXPANDED FROM 45.94 ATMOSPHERES TO ONE ATMOSPHERE.

$$T - T' \text{ (Calculated)} = 548.54.$$

366.7 (K) × 548.54 (T - T') = 201,149.618 ft. lbs. in 1 lb. of water.

201,149.618 × 62.5 lbs. = 12,571,851.1 ft. lbs. in 1 cu. ft. of water.

WORK DONE BY ONE POUND AND BY ONE CUBIC FOOT (37.77 POUNDS) OF LIQUID AMMONIA, AT 60° F. HEATED TO 400° F. AND EXPANDED FROM 16.8 ATMOSPHERES TO ONE ATMOSPHERE.

$$T - T' \text{ (Calculated)} = 411.16.$$

392.176 (K) × 411.16 (T - T') = 161,247.08 ft. lbs. in 1 lb. NH₃.

$161,247.08 \times 37.77$ (lbs.) = 6,090,302 ft. lbs. in 1 cu. ft. NH_3 .
 WORK DONE BY ONE POUND AND BY ONE CUBIC FOOT (37.77 LBS.) OF LIQUID AMMONIA AT 60° F. HEATED TO 500° F. AND EXPANDED FROM 45.94 ATMOSPHERES TO ONE ATMOSPHERE.

$$T - T' \text{ (Calculated)} = 562.66.$$

392.176 (K) $\times 562.66$ (T - T') = 220,661.75 ft. lbs. in 1 lb. NH_3 .

$220,661.75 \times 37.77$ (lbs.) = 8,334,394.3 ft. lbs. in 1 cu. ft. NH_3 .

WORK DONE BY ONE POUND AND BY ONE CUBIC FOOT OF STEAM CALCULATED FROM THE AVERAGE PRESSURE OF THE STEAM IN ITS EXPANSION.

This pressure is found by dividing 1 + the hyperbolic logarithm of the ratio of expansion by the ratio of expansion, and multiplying by the initial pressure.

The method will be found in Clarke's Manual, p. 825; Haswell's Engineers' Pocket-Book, p. 710, and Haeder & Powles' Handbook of the Steam Engine (1896), p. 151, and other similar works.

STEAM EXPANDED FROM 246.9 LBS. (400° F.) TO 14.7 LBS.

Volume of 1 lb. at initial pressure, 1.85 cu. ft.

Volume of 1 lb. at final pressure is 26.36 cu. ft.

R. (Ratio of expansion) is 14.248 Hyp. Log. = 2.6566.

Pm. (Average pressure) = $P \frac{R}{1 + \text{Hyp. Log. } R}$ = 246.9

R

$\times .2566$ = 63.3545 lbs. (Pm.)

63.3545 lbs. (Pm.) $\times 144$ (sq. ins.) = 9,123.05 lbs. per sq. ft.

L. (Length of stroke) 24.51 ft. $\times 9,123.05$ = 223,605.95 ft. lbs. in one pound of steam.

$223,605.95 + 62.5$ (lbs.) = 13,975,372 ft. lbs. in 1 cu. ft. of water.

STEAM EXPANDED FROM 675.3 LBS. (500° F.) TO 14.7 LBS.

Volume of 1 lb. at initial pressure, .714 cu. ft.

Volume of 1 lb. at final pressure, 26.36 cu. ft.

R. = 36.9189, Hyp. Log. = 3.608675.

Pm. = $P \frac{R}{1 + \text{Hyp. Log. } R}$ = .125 $\times 675.3$ = 84.125 lbs.

R.

84.125 lbs. (Pm.) $\times 144$ (sq. ins.) = 12,155.4 lbs. per sq. ft.

$12,155.4 + 25.646$ ft. (L.) = 311,737,388 ft. lbs. in 1 lb. of water.

$311,737,388 \times 62.5$ (lbs.) = 19,483,586.75 ft. lbs. in 1 cu. ft. of water.

SUMMARY OF RESULTS.

METHOD BASED ON SPECIFIC HEATS, HEATING FROM 32° F. TO 400° F. BEFORE EXPANDING.

Work done by 1 lb. of air expanded from 89.435 atms. 115,037.826 ft. lbs.

Work done by 1 cu. ft. (7.231 lbs.) of air, expanded from 89.435 atmospheres. 831,723 "

Work done by 1 lb. of carbonic acid gas, expanded from 35.4 atms. 75,316.02 "

Work done by 1 cu. ft. of liquid carbonic acid (59.1875 lbs.) expanded from 35.4 atms. 4,457,769 "

Work done by 1 lb. of ammonia gas, expanded from 4.188 atms. 94,801.096 "

Work done by 1 cu. ft. of liquid ammonia, (38.9625 lbs.) expanded from 4.188 atms. 3,693,688. "

Work done by 1 lb. of steam expanded from 16.8 atms. 146,511.318 "

Work done by 1 cu. ft. of water (62.5 lbs.

steam) expanded from 16.8 atms. 9,156,957 ft. lbs.

METHOD BASED ON SPECIFIC HEATS, HEATING FROM 59° F. TO 500° F. BEFORE EXPANDING.

Work done by 1 lb. of air expanded from 89.43 atms. 129,798.3 ft. lbs.

Work done by 1 cu. ft. of air (6.8565 lbs.) expanded from 89.43 atms. 889,897 "

Work done by 1 lb. of carbonic acid gas, expanded from 52.2 atms. 89,995.65 "

Work done by 1 cu. ft. of liquid carbonic acid (55 lbs.) expanded from 52.2 atms. 4,949,760.75 "

Work done by 1 lb. of ammonia gas expanded from 6.9 atms. 135,232.089 "

Work done by 1 cu. ft. of ammonia gas (37.77 lbs.) expanded from 6.9 atms. 5,107,716 "

Work done by 1 lb. of steam expanded from 45.94 atms. 201,149.618 "

Work done by 1 cu. ft. of water (62.5 lbs.) expanded from 45.94 atms. 12,571,851.1 "

Work done by one pound of ammonia gas, expanded from 45.94 atmospheres. 220,661.75 "

Work done by one cubic foot of liquid ammonia, at 60° (37.77 lbs.) expanded from 45.94 atmospheres. 8,334,394.3 "

THEORETICAL WORK OF STEAM CALCULATED BY METHOD BASED UPON AVERAGE PRESSURE DURING ADIABATIC EXPANSION.

Work done by 1 lb. of steam expanded from 16.8 atms. 223,605.95 ft. lbs.

Work done by 1 cu. ft. of water expanded from 16.8 atms. 13,975,372 "

Work done by 1 lb. of steam expanded from 45.94 atms. 311,737.388 "

Work done by 1 cu. ft. of water (62.5 lbs.) expanded from 45.94 atms. 19,483,586.75 "

THEORETICAL WORK OF CARBON DIOXIDE CALCULATED BY METHOD BASED UPON AVERAGE PRESSURE DURING ISOTHERMAL EXPANSION.

Work done by 1 lb. of carbonic acid gas expanded from 767 lbs. to the square inch and heating to 500° before expanding. 162,331 ft. lbs.

Number of lbs. of carbonic acid per horse-power hour expanded under above conditions. 12.19 lbs.

The writer does not believe that the ponderous storage battery is an ideal source of energy for the propulsion of motor vehicles. The advantages and disadvantages of the storage battery vehicle are well known to all engineers interested in the subject of horseless carriages, and the matter will not need discussion here. Neither does the writer believe that compressed air offers great promise, but believes that the most fruitful field for work will prove to be either in the development of interior combustion engines or engines with auxiliary devices for the employment of steam and other motor fluids expansively, and which may be carried in a liquid, and therefore, condensed state, with minimum of weight and space of container.

The writer is informed that the Westinghouse Company have produced a gas engine which is capable of developing a horse-power hour for each half pint of gasoline consumed. This is, indeed, a very high efficiency. It is claimed for the

Diesel Rational Heat Motor that about thirty-four per cent. of the combustion value of the fuel is converted into work. Something like this for motor vehicles, and with the usual disadvantages eliminated, is what is needed.

The Industrial Investment and Development Company, of 1123 Broadway, New York City, have produced an excellent engine for the use of carbon di-oxide, the gas being admitted to the engine under the pressure representing the full vapor tension of the liquid under normal temperatures, the gas being heated to a high temperature before being admitted to the engine, wherein it is given full expansion at a single stroke in each of its several cylinders. Although the claims made by the company are not borne out by the calculations of the writer, here presented, still, in justice to that company, the writer presents the following letter received from Mr. Hoornbeek, the president of the company, setting forth exactly what they do claim as based upon actual experiment. If these results can be attained, then we shall need some new data for our text books upon which to base our calculations. If such a result can be secured, it is certainly revolutionary:

Office of Industrial Investment and Development Co.,
1123 Broadway, New York City,
NEW YORK, March 16th, 1899.

MR. HUDSON MAXIM,
No. 219 West 34th St.,
New York City.

DEAR SIR: I have the honor to acknowledge the receipt of your inquiry concerning the White Carbon Di-Oxide Wagon Motor, and I will endeavor to answer your questions categorically.

1st. Our truck motor develops 35 brake H. P., and weighs 67 pounds. The appliances and apparatus for holding CO, sufficient for ten hours' full work will add 200 lbs. to the weight.

2nd. Our smallest wagon motor develops 15 brake H. P., and weighs 41 pounds, the additional appliances for holding gas sufficient for 50 hours' work under average conditions will weigh sixty pounds.

3rd. Our motors develop one horse-power per hour with less than three pounds of gas.

Our data is the result of actual experiment.

Very respectfully,

LODE. HOORNBECK,
President.

The writer is informed by Mr. Henry House, of Bridgeport, Conn., that he has produced a steam engine for motor vehicles, with attendant devices, whereby perfect control is had of the vehicle, the fire also being automatically controlled. Kerosene is used for fuel. The writer does not understand that he has, as yet, perfected a condenser for the re-condensation of the steam, and the weight of the boiler and engine is not at hand at this writing.

Exhaustive experiments have been made at the Cornell University with high pressure steam, which appears to argue promising possibilities, and the writer will quote from a paper by R. H. Thurston, presented at the New York meeting of the American Society of Mechanical Engineers, December, 1896:

"Summarizing the case, we may state the following as our conclusions from what has preceded relating to the 'promise and potency of high-pressure steam' within the limits here examined:

"(1). With equally excellent design, construction, and management, we may expect the efficiency of the steam

engine, with increasing pressures, to increase nearly as the logarithm of the boiler pressure.

"(2). We may hope to secure, at the highest pressures yet proposed, substantially as close an approximation to the efficiency of the ideal engine as those pressures which now give our best records, probably seventy per cent. of the efficiency of the cycle adopted, considered as an ideal, thermodynamic cycle.

"(3). That gain in economy, by increasing pressures simply, must be expected to be slow and to steadily decrease in rate of gain as pressures rise, making the practicable commercial limit a pressure comparatively low.

"(4). That assuming 1,000 pounds pressure safely and readily attainable, we cannot expect to reduce the demand for heat and steam below 6,000 B. T. U. per I. H. P. per hour, and about 6 pounds of steam; the probable figures being at least 20 per cent. higher.

"(5). At 500 pounds pressure, a steam consumption of 10 pounds and less has been attained under circumstances indicating that on a large scale the steam engine should, under similar thermal conditions, reduce this figure very considerably.

"(6). The direction in which to seek for gain is the reduction of internal wastes and the production of a super-heated steam engine."

By the use of very high pressure steam for the propulsion of motor vehicles, the weight of engine and boiler may be reduced to a minimum; and as devices have already been worked out for successfully controlling steam carriages, and for the automatic regulation of the fire, the chief problem at present appears to be the re-condensation of the steam, the boiler necessarily consisting of small tubes. Re-condensation appears to be indispensable in order to provide for the use of pure water, preventing incrustation and clogging up of the boiler and burning out of the tubes.

An atmospheric condenser, which, to be efficient must present a very large surface to the air, has many disadvantages. A water condenser has been proposed and experimented with, to some extent, and with success.

As with a motor vehicle, it is not so much a question of economy of fuel consumption for the supply of steam, as it is to take care of the exhaust steam; the fuel expense in any event being very low, some of the efficiency of the engine may be sacrificed for convenience and efficiency of condensation. Therefore, by admitting the exhaust to a condenser under a sufficient back pressure to cause the temperature of steam in the exhaust to be somewhat above that of boiling water, the steam may be effectually condensed by imparting its latent heat of liquefaction to water to evaporate the same under atmospheric pressure in a water reservoir surrounding the condenser tubes. The escaping steam being gently and steadily given off from the boiling water, may be passed into the products of combustion of the fuel to become heated and absorbed and thereby made invisible. Of course, in this event, it will be necessary to carry a supply of water for the purpose of condensation in excess of the weight of water which would be required with an atmospheric condenser; yet, on the other hand, the water condenser, on account of its smaller size, will of itself weigh much less than an atmospheric condenser of equal efficiency, and will offset, in a measure, the extra weight of water.

It is obvious that for the purpose of condensation water may be used without regard to purity or hardness, and which may therefore be picked up anywhere on the road, pure water being used in the boiler.

Motor Vehicle Grievs.

BY CHARLES E. DURYEA.

The path of the pioneer is not paved with roses, and the motor vehicle path has generally proved to be not paved at all. These remarks apply with much truth to both the motor vehicle maker and the motor vehicle user. When the writer first contemplated the application of the gasoline engine for vehicle service, more than a dozen years ago, a most potent obstacle was lack of public interest. Trolley cars were then curiosities, and to advocate replacing the horses with a mechanical motor marked one as an imbecile, whose views were so far against the vested rights of horse owners as to be almost criminal. The horse had been man's companion for so many years that civilization could not be thought of without him and our conception of the motor vehicle was so inadequate that supplanting the horse was not thought of. The only visible market was to be found among people too poor to maintain a stable. To meet this market a very cheap vehicle was required, and the outlook certainly was not inviting. The problem, however, was fascinating, and cheap, simple motors applied to ready made buggies were designed and built. Experience with them gave us new vision, and we began to realize that the motor vehicle surpassed the horse. This enlarged our possible market and permitted us to attempt to build a better vehicle. The result was, that by 1895 we had turned out a vehicle superior to the horse in many respects, as was proven by the Chicago *Times-Herald* race that fall.

The next obstacle was lack of financial interest. Although we had perfected the mechanical part so that we could travel farther and faster than a horse, and with a pleasure and comfort unapproached before; and although inquiries and orders were in sight, we could not interest capital necessary to put vehicles on the market. Successful business men, shrewd and sound in matters regarding their own affairs, failed to see anything in our invention, in spite of the fact that large enterprises were being built up abroad along similar lines. Others with more foresight, agreed with us as to the future of the business, but lacking our experience, proceeded to invest years of time and thousands of dollars to secure what we would have sold them promptly, for one tenth the sum. The result of this lack of interest among the public generally, the moneyed men and the press, is that America is several years behind the position she should have occupied in this new industry. We pride ourselves on our Yankee progressiveness, but the history of the past four years in the motor vehicle industry is one feather lost from our cap.

CHOICE OF MOTIVE POWER.

To come to more specific causes of grief, the motor may be first chosen. Of the many mechanical prime motors in use, none seemed wholly adapted to vehicle service and but one seemed capable of being sufficiently improved to meet the requirements. Steam engines, the best known, were inseparable from the boiler and accompanying troublesome and complicated fittings. Electrical motors, ideally simple, were tied to a heavy, unreliable and inefficient battery; a veritable millstone about the neck of a good thing, as the boiler was to a steam engine. The gasoline engine alone seemed free from these limiting features. It could be as

light as a steam engine or an electric motor, and was not tied to either battery or boiler. It was, however, not perfect for vehicle use, and many difficulties presented themselves in its adoption. It had to be simplified, lightened and rendered capable of giving various speeds at will. First, as a single cylinder for simplicity's sake, it gave too much vibration, which was remedied by making it double and afterwards treble. Although it could be built reversible, it was not practically so, and reversing gears were used instead. Primarily a gas engine, it had to be redesigned to adapt it to liquid fuel without a carburetor. To effect this result many experiments with feeding devices were made, and many of the troubles with this type of motor are to be found in the feeding device. Each type, under our experience, has developed, and we have been enabled to meet the conditions more perfectly, until we have to-day a feeding device capable of supplying a motor with a satisfactory mixture at speeds ranging from 100 to 1,200, in temperatures varying from 25 below to 100 above, and over all sorts and conditions of road surfaces.

IGNITION.

It is not sufficient, however, to have a suitable mixture. We must have a suitable means of firing it, and at once, under the varying conditions of the motor vehicle, the ignition problem becomes what is probably the most potent source of grief. Batteries without number, each well recommended, were tried. Sparking coils of all kinds and sizes kept company therewith, while sparking dynamos brought up the end of the list. The devices that would fire at moderate speeds would not fire at slow speeds, and a spark producer having sufficient capacity at slow speeds would be utterly inadequate at fast ones. Hot tubes and slide valves gave way to electric ignition, but even this is open to improvement. Electricity is a good servant in many places, but as an ignition agent it is not infallible.

A small light motor, boxed in to conceal it from sight and hearing, does not have excellent opportunities for heat radiation, and therefore requires more attention than common. In order to avoid weight but little water is carried, and but small water jackets used. Overheated parts were of common occurrence, and can only be avoided by most careful designing. If a pump circulation was used, the pump gave trouble. If much piping existed, it would freeze up on cold days on short notice. If tanks were placed outside the vehicle they were unsightly and liable to burn innocent fingers, while if placed inside they trespassed on valuable space. In hot weather much steam was made, and in cold weather the little made showed very plainly.

TRANSMISSION.

After having secured a fairly satisfactory motor, equipped with reliable feed and the best ignition system and protected from damage by overheating, the next problem was to transmit its power to the vehicle. Friction devices looked very pretty, but wore out rapidly, and failed utterly when wanted most. Gears were costly, heavy and noisy, but were positive in action. Chains did not adapt themselves easily, stretched badly and were given to breaking, but they were less noisy than gears, and more suited to the flexible conditions under which they were obliged to work. Belts were simple, light, noiseless and flexible. They required much room, however, stretched badly when needed most, refused to run on the right pulley at most inopportune moments, and behaved gen-

erally in a manner totally foreign to common shop experience. Other less common devices were tried, with less satisfactory results. Not only was it necessary to drive, but wide ranges of speed were necessary, which added very materially to the difficulties of the problem. Motors were first equipped with governors, and all speed changes effected by the mechanism, but further experiences caused us to improve the motor and simplify the driving machinery. It is not difficult to place shafting in line and hold it so in a permanent building, but in a light vehicle body, winding and twisting constantly under each vibration of road or load, the problem becomes almost unsolvable. If placed on the running gear, much room was required and the road vibration proved very destructive. If placed in the body, suitable means of transmitting the power to the drive wheels was required.

THE FINAL SOLUTION

Was found by using a strong body, mounting the motor and machinery on it, and linking the wheels to it. Unexpected results were often found, requiring new designs. For example, rear axles revolving, failed to carry anything like the load ordinary axles of similar size were carrying. Greater sizes and improved designs were required to meet such trouble. Stronger wheels, better springs and better steering devices were found necessary. For the same reason the use of nuts and screws became objectionable, and the complicated construction had to be replaced by more simple design. Not only in matters of utility, but in general appearances, there was much to be overcome. To avoid public prejudice horse vehicle forms were first sought for, and while better than traction engine forms, they lacked fitness, and so were not beautiful. A longer use pointed out forms better adapted to the requirements, and therefore, more beautiful. The result of the total experience is found in a light-weight vehicle, having few parts, large power, high speed, graceful appearance, easy to control, and pleasant to use. It is not possible to secure the desired result without a varied and grievous experience, but could the many difficulties have been foreseen it is doubtful if the work would have been begun. One thought brings consolation, however, viz., others have found similar griefs in striving for similar results, while many have failed before reaching the desired end.

Airy Autotruck Reports.

Joseph Leiter is the leading spirit in the organization under New Jersey laws of the International Power Co., with a capital of \$8,000,000, which is said to be a parent company, to numerous other motor truck companies which are to follow in the wake of the New York Autotruck Co. Mr. Leiter announces his intention to sail soon for Europe to form autotruck companies in London and on the Continent. The manufacturing will be done on this side, but just what will be manufactured the promoters of these gigantic enterprises have so far refused to divulge.

They estimate that there are 110,000 work horses in New York City, and that the substitution of motor trucks for this vast number of beasts should yield a fair return on \$2,000,000-000 capital.

The New York Autotruck Co. is now said to be building a fire engine propelled by compressed air for the New York Fire Department.

The General Relation of Tires to Motor Vehicle Construction.

BY VIATOR.

When so many people are looking at the motor carriage from a somewhat specialized point of view—the tire makers looking at the tires, the engine makers looking at the engine, and all kinds of cranks looking at the mechanism between the two—it would seem to me that one might with advantage consider the question of the bearing of these various parts one upon the other.

I am satisfied that the tire makers are giving us now a very good article, nevertheless, I am also satisfied that this good article is being very much abused. If the reader happens to be a fly fisherman, he will know that a five pound fish may be landed with a quarter pound rod, provided the rod is springy enough and properly applied. It is the neglect of this fact in the construction of motor vehicles, I am satisfied, which causes most of the trouble with the tires.

Two or three years ago a discussion took place before the Society of Electrical Engineers upon the subject of motor carriages. At this time it was strongly advocated that the motor should be placed directly upon the rear axle of the carriage, the main reason given for this being that such was the best construction, at the time, in the trolley car. I hope we have all outgrown such an idea as comparing these two forms of vehicles. The fact alone that one has a smooth road and the other a rough one is sufficient to change the problem entirely.

To state my proposition clearly; I believe that the life of the tire, of the wheel and of the rear or driving axle, is dependent upon the amount of dead weight which is placed upon such axle, wheel and tire. By "dead weight" I mean to distinguish between the weight upon the rear axle immediately, and the weight which is transmitted to the rear axle by means of the springs. The makers of tires for carriage purposes, in their circulars and price lists advise certain sized tires for vehicles of a given weight, taking no account of the method of construction. Let us look into this matter a little more carefully. Let us suppose a driving axle of a motor carriage which has a so-called direct geared motor attached to it. I refer to an electric motor at present. If the said electric motor is perpendicular above the driving axle, it is forced to move in a perpendicular direction every time the driving axle passes over the slightest obstruction, and if it does not move in this perpendicular direction, it is only because the tire, the wheel, or the rear axle, bends.

On the other hand, if the electric motor, geared direct to the driving axle, either by means of a pinion and spur gear, or by means of a chain and sprocket, be placed horizontally from the driving axle, either immediately before it or immediately behind it, the relative distance of the two being determined by links of proper length, the same effect is *not* produced. In this case an obstruction upon the road causes the wheel and rear axle to rise sufficiently to pass over said obstruction. No effect, however, is produced upon the position of the motor.

The difference, briefly, is that in the first case one strikes upon the driving tire with a rigid hammer, the weight of which is equal to the weight of the motor, the axle and the wheel. In the second case, however, the weight of the motor being supported directly from the body of the car-

riage by means of springs, perhaps, is only affected in this position by the motions of the carriage body itself. It will be seen by any observer that these motions are vastly fewer, less rapid, and less abrupt than the motions of the rear axle and wheel.

In proof of this, every motor carriage owner has noticed that the tires on the steering wheels last far longer than the tires on the traveling wheels. I am ready here, immediately, to anticipate an objection. I know that the average motor carriage owner and builder will promptly say that this fact is due to the greater weight upon the driving wheels and to the fact that the wheels are used as driving wheels, as well as merely to support weight. The first of these objections has weight. The second of these objections, I think, upon looking closely, we will see to be of very little importance. The average motor carriage can climb a hill of not more than 15 per cent. Put in other words, this means that the tractive force at the rim of the driving wheels is 15 per cent. of the total weight of the carriage. Looked at in this way it will be immediately seen that the extra strain upon the driving tires is only slightly in excess of that upon the steering tires, except only in so far as they actually bear a greater proportion of the real weight of the motor carriage.

I think I am safe in saying that no more than two-thirds of the weight of the average carriage rests upon the driving wheels; in some cases much less than two-thirds would be the case. From this one would expect that the steering tires should last a little more than double as long as the driving tires, provided they were of the same initial strength of manufacture. Common experience shows that this is not the case. I, for instance, have used one set of steering tires for a year and a half, and they show no signs of wearing out, whereas my driving tires were badly cut within three weeks, and began to give me serious trouble within three months. Another point, from my own experience. Bearing out my general proposition above stated is the fact that the rear axle of a carriage which I have used, with the axle bearing considerable dead weight, as I have above described, broke twice within eight months, although the axle was fully heavy enough had it been used upon an ordinary horse carriage of the same weight.

I am satisfied that this double breakage was due, not to the fact that the axle was the driving axle, but to the fact that it supported by rigid links a countershaft of the weight of about 120 pounds, the position of the countershaft being almost directly above the driving axle. I am fully convinced that tires, wheels and rear axles may all be lightened with advantage if the above point in construction be attended to.

The Victor Motor Carriage.

The Overman Wheel Co., Chicopee Falls, Mass., who have been experimenting with gasoline motors for two years past, and who announced that they were about to manufacture a vehicle propelled by that power, have evidently abandoned that motive agency and come forward with a steam carriage, which they claim is the only automatic one in the world.

The first Victor steam carriage will be a 600-pound stan-hope for two, propelled by a 4 H.P. vertical steam engine, and capable of climbing a 25 per cent. grade and running twenty-five miles without supplies.

Mr. Overman states that he thinks "steam is by far the best power for motor vehicles."

Motor Mail Wagon Wanted in Bombay.

Kirloskar Bros., importers of bicycles and general machinery, Bombay, India, have been requested by the Government to undertake to carry mail by motor vehicles over good roads, about 100 miles in length. There are many hills to be surmounted, and during the wet season, which lasts four months, the rains are heavy. The maximum load is 300 pounds of mail, plus the weight of a driver and servant.

The vehicle for this use should be very strong, simple and reliable, with tires that can easily be replaced. Kirloskar Bros. believe they must choose between kerosene and steam, and would be glad to hear from parties who can furnish the required vehicle.

New Model Riker Delivery Wagon.

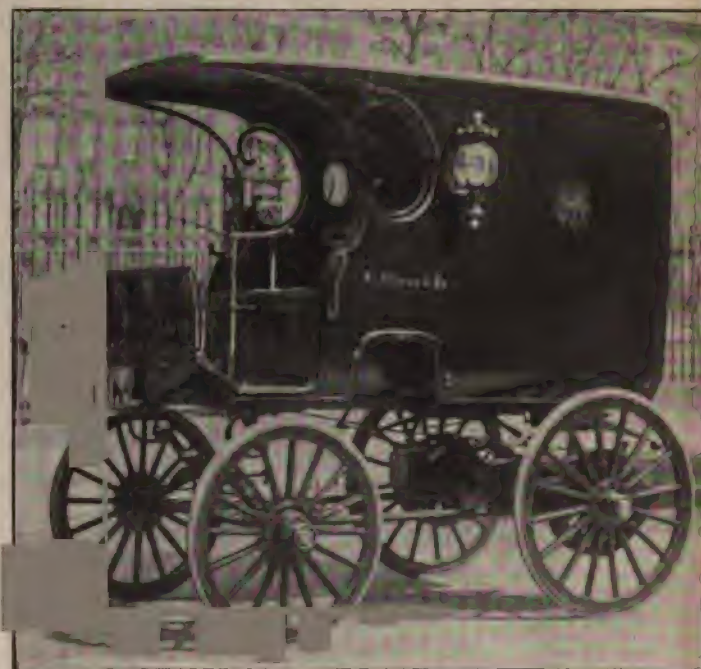
The new delivery wagon just brought out by the Riker Electric Motor Co. differs from the first one chiefly in the wheels, which are of wood, and in the greater mileage of the battery. The front wheels are 38 inches, and the rear wheels 42, two-inch pneumatics being used. The wheel base is 68 inches, and the tread 59 inches.

Two 2 k.w. motors are employed, and a combination voltmeter and ammeter.

The front wheels are the steering and the rear ones the driving wheels. The controller gives three speeds ahead and two backward.

The vehicle weighs 3,600 pounds, and has a carrying capacity of 1,000 pounds, in addition to the operator and the delivery man. A maximum speed of nine miles an hour, and a total mileage of thirty from one charge on level macadam roads, are attained.

Electric side lights are used.



NEW MODEL RIKER DELIVERY WAGON.

PUBLIC VEHICLES.

A motor omnibus is to be put in service in Denver, Col., this summer. It will have a seating capacity of fourteen and will make ten trips a day.

The Board of Public Works, Holyoke, Mass., is thinking of providing its superintendent of streets with a motor vehicle to enable him to cover his territory more easily.

The Consolidated Street Car Co. was organized in New Jersey last month with a capital stock of \$18,000,000, to operate street cars and motor vehicles. The incorporators are William P. Chapman, of New York; Albert S. Ridley, of Brooklyn and Francis D. Pollak, of Summit, N. J.

The Washington Automobile Co. has been organized at Washington, D. C., to operate electric omnibuses and cabs in the nation's capital. The capital is \$750,000, and the officers are: President, H. D. Mirick; vice-president, Charles A. Lieb; secretary and treasurer, James B. Lackey; directors, O. T. Crosby, Frederick C. Stevens, and G. H. Young.

W. N. Shine, A. H. King, C. J. M. Shine, D. G. Ambler, S. T. Shaylor and H. W. Clark have petitioned the City Council of Jacksonville, Fla., for the right to run motor vehicles in all the city streets in connection with or instead of trolley lines and to operate a general motor livery service. The petitioners offer one-third of their stock to the city, the mayor of which is to serve as a director on the board.

The Nassau Motor Coach Co., with \$150,000 capital, has been incorporated at Rockville Centre, L. I., to operate motor stages in that section. The incorporators are John W. De Mott and Paul K. Ames, of Rockville Centre; Henry I. Nichols, Hempstead; William J. Miller, Freeport, and Austin Cornwell, Ocean Side, Long Island. The company is to be tributary to the Nassau Trolley Line. Electricity will probably be employed for motive power.

The New England Electric Vehicle and Transportation Co. had its birth in New Jersey on March 23. Its chartered objects are to manufacture, sell and operate motor vehicles, and the incorporators are James E. Hayes, Camden, N. J., and Arthur Phillips and Augustin Treadwell, Jr., of New York. The company is one of the offshoots of the Electric Vehicle and Transportation Co., of New York, and the Electric Vehicle Co., of the same place.

The Committee on Public Improvements, comprising the whole Board of Aldermen, gave a public hearing March 21 in the petition of the Boston Transit Co. for permission to operate motor vehicles on the streets of Boston, Mass. The company wishes to run three continuous lines of electric cabs, the first from St. Mary's street to the northern depots, for the benefit of the Back Bay districts, the second through the Fenway, and the third from Franklin Park, via Columbus avenue.

Papers have been drawn for the incorporation of the Buffalo Automobile Co., Buffalo, N. Y., with a capital stock of \$100,000, to operate lines of motor stages and establish a general motor livery business. The organizers of the enterprise are Jewett M. Richmond and Dr. Truman J. Martin, the latter a prominent physician who has owned an electric carriage for some time. Several different types of vehicles have been ordered of the Electrical Vehicle Co., of New York, and it is expected some will be in service in June or July.

The petition of Simeon D. Haskell and others to the Chicago South Park Board for the exclusive privilege of running a line of motor stages on Michigan avenue and through the south parks, was refused on the ground that it had always been against the policy of the Board to grant park privileges, and that many property-owners along the route objected. The petition offered the commissioners 10 per cent. of the gross receipts, and also agreed to sell commutation tickets of ten rides for \$1. The matter will be further pressed before the Board, and if the license is still refused resort will be had to the State legislature.

At a meeting of the Executive Committee of the Park Board of Buffalo, N. Y., it was decided to give the contract for public stages to the National Motor Transit Co., who will probably furnish electric vehicles under a franchise going into effect April 1 and expiring January 1, 1900. The distance traversed will be 3½ miles, and the fare charged will be five cents.

The National Transit Motor Co. is to be held responsible for any accidents through negligence and is to give a bond of \$50,000 to the board, securing the city and the board from any liability from actions at law. The company binds itself to put in operation August 1 at least four carriages, the design of which is first to be submitted to the board and by it approved. These carriages are to be run at intervals of at least 30 minutes each way, from the termini, from November 1, and after that at such intervals as may be deemed best by the company. No decrease in this number shall be made except by permission of the board. The company also agrees to conform to all park ordinances relative to use of road, to stop its carriages at any point where passengers desire to get on or off, to stop the machinery in case of horses becoming frightened, and not to run faster than eight miles an hour. The employees are to be uniformed.

The contract or license can be terminated at any time at the option of the board. The carriages are to be odorless and noiseless, so far as deemed practicable by the board.

Automobile Company of America.

This company, recently organized under the laws of Maine with an authorized capital of \$5,000,000, is a close corporation, counting among its owners some of the leading capitalists of New York. Its charter is very broad, empowering it to engage in all branches of the motor vehicle business, but it is the company's intention to confine itself to all kinds of gasoline vehicles, of which a number will be ready for the spring trade.

The company has made a coup in the purchase of the American rights of the Decauville carriage, illustrated in our November number, and will put out a light carriage of similar construction in the near future. They have made a contract with the American Motor Co., for the use of their well known special vehicle motors, and will soon show fine different types of gasoline vehicles, from the light tricycle to the truck capable of carrying five tons.

Among the parties interested in the corporation are John H. Flagler, Robert L. Stevens, E. P. Kimball and Albert T. Otto and Frederick R. Blount of the American Motor Co. The company's office is in the Hudson Building, New York.

The Marsh Carriage Co. have taken a factory at the corner of Crescent and Perkins streets, Brockton, Mass.

The Crouch Steam Carriage.

W. Lee Crouch, of New Brighton, Pa., who built the gasoline motor for Dr. Booth's carriage, Youngstown, O., has constructed a steam carriage, herewith shown.

The frame, rectangular in shape, is made of $1\frac{7}{8}$ in. cold drawn seamless steel tubing. It supports everything, and also forms the bed plates or girders for both motors.

The generator consists of one vertical column of 5 inch steel casing, with the ends welded in, and four branches or manifolds screwed in, and brazed to the column; two of them at the bottom and two about one-third of the distance from the top. There are four sets of double-pitch coils of steel tubes of $\frac{3}{4}$ inch outside diameter and 1-16 inch thick, wound so as to leave sufficient space for the heat to pass all around them, and joined securely to manifolds at top and bottom. There is also a super-heating coil, which leads from the top of the column and passes down through the heating and combustion chambers, and thence to the motors. Outside the coils is placed a planished iron jacket thickly lined with asbes-



tos. The weight of the generator is 110 pounds. In a close pan over the bottom is placed the kerosene oil burner and re-tort. The exhaust steam and products of combustion combine and are discharged at the rear. The fire is controlled by the pressure, automatically. The feed water is automatically controlled by a reliable device not explained. The motors, two in number, have cylinders of 3-inch bore and 6-inch stroke, both operating on one crank shaft, with cranks set at 90 degrees to each other. The cylinders are super-heated steam jacketed all over, and have poppet valves placed in the cylinder heads. The clearance is less than a half of one per cent. The valve gear is so arranged that it varies the cut-off from 0 to $\frac{3}{4}$ stroke, and does not change the time of the exhaust, compression and admission, giving a wide open, or full open port when cutting-off as short as 1-12 stroke. No fly-wheel is used. A small disc on the crank shaft of the motors, surrounded by a strap, serves as a foot brake. The motors make one and one-half revolutions to one of the driving wheels, which are 32 inches in diameter. The pump that feeds water to the generator is worked by the crosshead of one of the motors. The motion of the motors, both starting and stopping and cutting off, are controlled by one lever.

The pressure gauges for the generator, the oil tank and the water indicator, are all on the dashboard in front. Steering is on the bicycle order, and the vehicle can be wholly operated from either side.

It is equipped with a syphon and hose, so that it is not necessary to get out of the vehicle to take water, unless the water

is more than 12 feet away. The tank, holding sixteen gallons, can be filled in two minutes. The oil tank, one of twelve gallon capacity, is under the foot board in front, and there is plenty of room under the seat for extras. The carriage weighs



empty, 650 pounds. The fire regulator is set for 250 to 275 pounds pressure per sq. in., and the safety valve is set for 300 pounds. The generator is said to have been tested to many times that amount, and would be safe at 1,000 pounds working pressure. The steam is super-heated to about 600° F., as it comes to the motors. There is no moisture in it and no cylinder condensation. The outfit gives a horse-power, when working most economically, on less than 20 pounds of water per hour.

The consumption of fuel is one quart of common kerosene oil per horse-power. Gasolene can also be used without change in the burner. Mr. Crouch, states that on January 24th last, when the mud was as deep as any time this past winter, he took with him a man weighing 200 pounds and made a tour of Beaver County, where he resides, going fully



25 miles, and climbed the worst hill in the county. In many places on the level the hubs of the wheels would scrape the mud. He had no trouble in keeping pace with the electric cars in this mud and ran away from them on the steepest hills. This he thinks, surely required an output of eight mechanical horse-power at times. On January 30th last, in company with a gentleman from Wheeling, W. Va., he made the run from a point in Rochester, Pa., to a point in Beaver Falls, Pa., over frozen, hilly and muddy roads, $4\frac{1}{2}$ miles in fifteen minutes. Mr. Crouch has associated with him in the enterprise Lewis R. and Frederick Davidson, of Beaver Falls, Pa.

LONDON NOTES.

LONDON, March 21st.

The London Electrical Cab Co. has put in a charging plant, overhauled their cabs, and put many new cabs in service. They are also preparing to introduce a brougham to let to private parties.

Benz & Co., of Mannheim, Germany, whose little two-seated carriage is exceedingly popular both on the Continent and in England, have just converted their business into a joint stock company with a capital of \$750,000.

Quite a number of the English cycle manufacturers are interesting themselves in the construction of motor vehicles. In Coventry there are the Progress Cycle Co., the Raglan Cycle Co., and Bayliss, Thomas & Co., makers of "Excelsior" wheels, while in London several smaller makers are quietly building experimental vehicles.

Follow the example set by the British and German Postal authorities, the Dutch postal department is now about to carry out some experiments with vehicles. About twenty firms responded to the department's invitation, but of these vehicles from only four firms—one English, one German and two French—have been selected, and these are to be experimented with in May.

Passing down the Strand, the other day, I noticed that one of the New York electric cabs had found its way to London. I saw it just as it passed the cab-stand on which are stationed the London electric cabs and as may be imagined, the stranger came in for a good deal of criticism. I have not been able to ascertain, so far, who on this side is responsible for the appearance of the new cab.

The motor movement is steadily making its way in Germany. Several new companies have lately been formed either to build or import vehicles, while particulars of still another one have just come to hand. This is Die Gesellschaft für Verkehrsunternehmungen, of Berlin, registered with a capital of \$450,000, to manufacture and operate electric motor vehicles. The new concern has a very powerful backing, including several leading German electrical engineering concerns and also the Motor fahrzeug und Motorenfabrick, of Berlin.

The German motor carriage, hitherto known as the Lutzmann, is henceforth to be called the "Opel." The cause of the change is that Herr Lutzmann, of Dessau, who has hitherto built these vehicles, has sold his works and business to the old established cycle manufacturer, Adam Opel, of Russelsheim-am-Main. The plant, which is being removed to the latter place, will, however, still be under the direction of Herr Lutzmann. Herr Opel intends to turn out all sorts of petroleum carriages, from a two-seated carriage up to a twenty-five-seated, twenty H.P. omnibus.

Ever since Pennington placed his new motor carriage on exhibition at the National Cycle Show at the Crystal Palace in December last, the vehicle has received an unusual amount of attention in this country, and orders are reported to be pouring in. It is stated that the Pennington firm, who are not building their own vehicles but having them made to their specifications, have no less than 2,000 orders, and are now calling for bids from engineering firms for another 2,000. Although a good deal of scepticism is still being shown in regard to Pennington and his vehicle, there can be no doubt he is getting orders for them at a rapid rate, and it is announced that after May 1 the present price will be advanced 12½ per cent.

According to the *Automotor* the Steam Carriage & Wagon Co., Chiswick, London, have built a number of steam drays for leading brewers of Great Britain, which are giving satisfactory service.

S. F. Edge, managing director of the Progress Cycle Co., Coventry, England, in a paper recently read before the Automobile Club of Great Britain, advocated much wider pneumatic tires for motor vehicles, even to one foot in diameter.

The American Automobile & Motor Co., Ltd., the concern which placed such large orders for American vehicles last fall, was recently registered in England with \$400,000 capital as general manufacturers of motor vehicles and accessories, and dealers in them. The directors are: Frank L. Gardner, president; Albert Geiger, vice-president; and Sebastian Schlesinger, Rene de la Ville Le Roulx, Baron Paul de Vilaine and Pelayo Soberano.

A writer in a recent issue of the *Autocar* states that he has had four years' experience with kerosene vehicle motors, and finds that they do not clog or emit foul odors when properly governed, which he thinks should be done by a brake on the fly wheel, so as to keep the motor working under full load. The difficulties of the kerosene motor have been exaggerated and all attention centered in the gasoline motor. He believes the kerosene motor will at no distant day compete with the gasoline motor for vehicles.

Liverpool Heavy Motor Trials for 1899.

The second competition for heavy motor vehicles under the auspices of the Liverpool Self Propelled Traffic Association will occur on Monday, July 31, and Tuesday and Wednesday, the 1st and 2nd of August, in conjunction with the Royal Lancashire Agricultural Society. Trial runs will be made from Liverpool over distances of from 30 to 40 miles in two successive days. The distance between any two of the depots provided for the supply of water will not exceed 12 miles. Route maps of each course will be issued.

Among the requirements are the following: The vehicle shall be capable of working into and out of any embayment of one and a half times its own length; it shall be capable of starting from rest on and mounting a 10 per cent. grade; the water tanks must hold a supply sufficient for 15 miles; all manoeuvres shall be performed under full load.

Four different classes of vehicles shall be entered:

Class.	Minimum Load.	Maximum Load.	Minimum Level Platform Area.
A	2 tons.	2 tons.	50 square feet
B	3½ "	3 "	65 " "
C	5 "	3 "	80 " "
D	6½ "	4 "	110 " "

The points to be considered are cost, control, working and construction, and the special features requiring attention in gasoline, steam and electric motors.

The competition is international, and vehicles entering must be registered as arrived at the show yard of the Royal Lancashire Agricultural Society, Wavertree Recreation Ground, Liverpool, not later than noon on Friday, July 28, 1899. Entries must be made on printed forms obtained from the Hon. Secretary, E. Shrapnell Smith, of the Self Propelled Traffic Association, and must be accompanied by an entry fee of five guineas for each vehicle.

MINOR MENTION.

The Duryea Manufacturing Co., Peoria, Ill., expect to have motor bicycles ready for the market by midsummer.

George Barber, wagon builder, Danbury, Conn., has nearly completed a motor carriage to be propelled by gasoline.

"The Armstrong Bros." Tool Co., 106 W. Washington street, Chicago, Ill., will shortly take up the manufacture of motor vehicle parts.

The Oakman Motor Vehicle Co., Greenfield, Mass., are making the first shipments from the lot of fifty carriages they first put through.

E. L. Orcutt, an inventor of Somerville, Mass., recently tested a steam carriage, on which he has been engaged for more than a year past.

Ishan Sedgwick, of Richmond, Ind., has built a pair of rotary engines, which he proposes to mount in a 12 passenger wagon, weighing all told, 1,800 pounds.

Frank Stutsman, of Eliot & Stutsman, machinists, Williamsport, Pa., has invented a friction disk transmission for motor vehicles, on which he has applied for a patent.

The Winton Motor Carriage Co., Cleveland, O., are adding to their force and increasing facilities as fast as possible. They can promise early delivery if orders are placed soon.

The International Tire Co., 41 High street, Boston, Mass., are making a tire with a spongy tread, which they claim relieves the sides of a large part of the strain and increases the life of the tire.

The Wire Goods Co., Worcester, Mass., make all kinds of wire spokes up to $\frac{1}{4}$ inch thickness, swaged or unswaged, and with bent or straight ends. Stanley Bros. recently placed an order with them for 16,000 spokes.

The American Motor Co. will soon complete a large order for their No. O. double cylinder motors. Instead of cast iron they now employ a special gun iron for cylinder and pistons, which is twice as strong and takes a much higher finish than cast iron.

Dr. J. W. Jesse, one of the leading physicians of Santa Rosa, Cal., has had a motor carriage constructed in San Francisco for use in his practice. It is of the gasoline motor type, with three speeds, from nine to eighteen miles an hour, ahead, and a reverse speed of nine miles. He is well pleased with its action.

It is rumored that Holt Bros., manufacturers of agricultural machinery, Stockton, Cal., are about to embark in motor vehicle construction. It is said that they have engaged a prominent mechanic and inventor of their city as chief engineer, and that he has a new type of gasoline motor under construction.

On March 1, the International Vehicle Co. of New York City, with \$5,000,000 capital, was chartered under West Virginia laws, by W. P. and C. W. Hatch, H. C. Underwood and H. F. Adams, of New York, and C. C. Isbel, of North Adams, Mass. All kinds of motor vehicles will be made and operated in the large cities of the country.

The Holyoke Motor Works, Holyoke, Mass., are fitting up their new factory at the corner of Sargent and Commer-

cial streets with all the necessary machinery for the production of ten wagons a month. They will make their first shipment abroad to the American Motor Agency about the first of April. In conjunction with their works they will operate a foundry, where they will produce semi-steel castings for cylinders and other parts for their own use and for the trade.

A good motor vehicle chain is not easily found. The Baldwin Cycle Chain Co., Worcester, Mass., make special chains for this purpose—5-16, 3-8 and 5-8 chains, of one-inch pitch, and an extra heavy nickel steel $\frac{1}{2}$ or 5-8 chain of $1\frac{1}{2}$ inch pitch, for a 13-32 sprocket tooth. These chains are made of the best material, are detachable, and all parts are interchangeable.

The National Motor Carriage Co., builders of the Duryea motor carriages, are putting out three different types of vehicles, a one or two-seated trap, a slightly modified Stanhope phaeton and a touring cart, each of which weighs from 700 to 800 pounds, has wire wheels and either pneumatic, cushion or solid tires, as desired. An automatic starting device is one of the chief improvements.

The Baker Mfg. Co., recently incorporated with a capital of \$100,000, will soon begin the manufacture of motor vehicles at Tarentum, Ia. The incorporators are James H. Baker, formerly of the Baker Chain and Baker Forge companies; Henry M. Breckenridge and James D. Wilson, of the Tarentum Glass Co.; John W. Hemphill and O. C. Camp. They will also make heavy forgings for wagons.

The United States Automobile Co., of Pawtucket, R. I., was recently incorporated with a capital stock of \$150,000 for the purpose of manufacturing electric carriages and appliances. The incorporators are Frank Mossberg, of Providence, R. I., president; Dr. Julian A. Chase, Pawtucket, treasurer, and D. McNiven, of Pawtucket, secretary. The company has taken quarters at 623 Atwell's avenue, Providence.

Robert H. Cloughley, 2309 Forest street, Parsons, Kan., writes that he built the first motor vehicle in Kansas in 1896, and that he has been working on the improvement of the gear ever since. He is now making some complete gears for a St. Louis firm who propose to build trucks of 4,500 pounds capacity. He thinks he will soon be able to furnish complete gears of all kinds for pleasure and business vehicles, which he will sell to those wishing to construct their own vehicles.

Grout Bros., of Orange, Mass., are going into the motor carriage business in earnest. They have secured a factory with 25,000 square feet of floor space, and are filling it with the latest improved machinery for this class of work. They have perfected a new chain driving mechanism, and several other improvements which will appear on their new models. By a very ingenious device they can apply oil enough to the main axle bearings at one application to last for a run of 10,000 miles.

Owing to the high degree of heat generated in the cylinder of the gas engine by the explosion the question of lubrication has always been a difficult one to solve in this class of engine. Graphite, as is well known, stands any degree of heat and is the finest lubricant for high speed machinery. The Joseph Dixon Crucible Co., Jersey City, N. J., prepare a special brand, called Dixon's No. 635 Flake Graphite, for this purpose, which is employed by many leading builders and users of gas engines.

MACHINERY and TOOLS for motor vehicle builders

Readers using information from this department are requested to give credit.

The Grinding Machine.

The grinding machine is destined to play an important part in the manufacture of motor vehicles. It is taking the place of the lathe in many of the best machine shops of the country for cylindrical work of regular shape, straight or taper, up to 30 x 4 inches, or even 48 x 7 inches on machines of larger size. It obviates entirely the use of the file in finishing, and enables the manufacturer to turn out work in large quantities with ordinary operatives, as feeding and sizing are all automatically attended to.

The Brown & Sharpe Mfg. Co., of Providence, R. I., have recently designed a very complete Plain Grinding Machine for work of this class. After roughing out in the lathe, they claim that shafts can be sized much quicker on such a machine than in the lathe, and with better finish and greater accuracy on unhardened material.

The American Motor Co., of New York, employ one of these machines in finishing cylinders, which come from it so smooth and bright that the usual "breaking in" is unnecessary.

Another very useful grinding machine is the Disc Surface Grinder, manufactured by the Geo. Gorton Machine Co., Racine, Wis. It is provided with four steel discs, gluing



GORTON DISC SURFACE GRINDER.

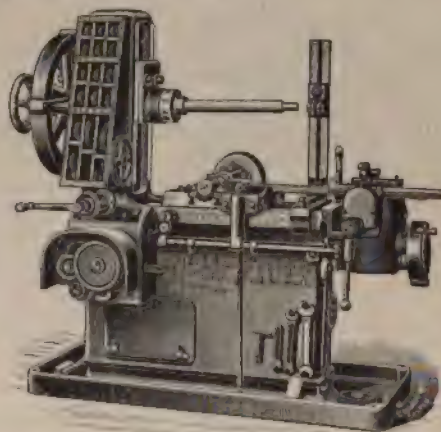
up press, wrenches, countershaft complete, a gallon of special quick setting cement and other accessories. The base is a substantial casting, heavily ribbed internally. Its construction prevents all vibration in the tables. The left hand table is graduated in degrees and may be quickly adjusted. The right hand sliding table is perfectly dust proof and self oiling, and has a very easy movement with jerk or jar. The disc may be quickly removed without losing the adjustment of either table. All flat surfaces are scraped to surface plates, and each table is provided with adjustable tee squares.

This machine is particularly adapted for the finishing of flat parts of dies, connecting rod ends, nuts, flat spots on levers, the ends of steel rods, small governor parts and attachments, fitting keys and other flat surfaces, either hard or soft, and is also used in finishing the rounded end of straps or connecting rods, which may be swung on a center stud and forced against the cutting discs.

New System of Automatic Gear Cutting.

Gould & Eberhardt, of Newark, N. J., have brought out an innovation in the gear cutting line, which cuts gears without further attention than the setting. In appearance it resembles their well known "New Type" machines. Every moment is complete in itself and unless all previous movements are fully and correctly completed the next cannot take place.

Only one belt is used in driving, the pulley shaft being geared direct with the dividing, cutting and driving mechanism, respectively. All are driven and drive their respective movements by spiral gearing and furnish positive separate movements. This feature does away with the numerous imperfect and tricky belts which prove costly on so many machines now on the market.



The improved positive dividing mechanism is a decided feature. The worm wheel is made in two sections and is positively correct. By the simple movement of a lever, the worm can be engaged for working and disengaged for testing. A micrometer adjustment allows for the turning of the worm wheel by hand to permit any recutting of teeth if desired. The worm and worm wheel are entirely encased.

When desirable, the cutter can be fed through or returned by hand. A new and novel style of handle is employed to perform this, and whenever it is not being used it disengages automatically from the feed and remains stationary. A support which rests central on the sliding surface holds long mandrels firm and rigid, so that it is not necessary to disturb the adjustment in the changing of work. Chips are deposited automatically in the base of the machine. An automatic oil pump easily detached, conveys lubricant to the cutter. A large patented oil pan forms the base of the machine. Besides forming a receptacle for lubricating oil it catches all drippings which would otherwise soak into the floor. Bearings are of phosphor bronze, and all sliding surfaces are scraped to standard surface plates. Workmanship throughout is of the highest standard.



After setting the work and starting the machine, no attention need be given it until the gong notifies the operator of the completion of the gear. There is a conspicuous absence of cones, belt-tighteners and all such features which have proved detrimental to gear cutting machinery. It has no intricate and delicate mechanism to confuse the workman, get out of order and spoil work.

In connection with the above machine, Eberhardt's patent system of Radial Duplex Gang Cutters is used. They are made in gangs of two or more separate cutters as illustrated, cutting at once from two to twelve finished teeth, according to the nature of the metal, size of gear and pitch. In this manner quantities of similar gears can be produced at great reduction in cost.

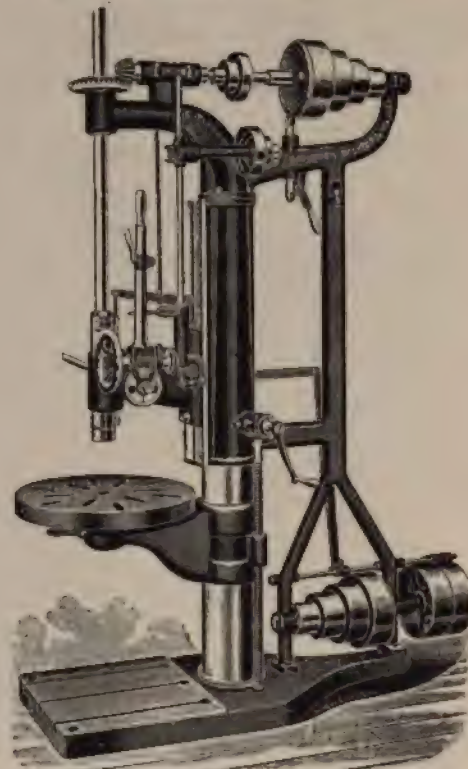
Some manufacturers are putting in a very large turret lathe for hubs and similar work, having a $3\frac{1}{2}$ -inch feed. Such machines are made by Bardons & Oliver, Cleveland, O., and by the American Machine Tool Co., Cincinnati, O.

In cases where operations are to be performed on both ends of a piece, as in solid rollers for bearings, screws and bolts, spoke nipples and hubs, the Spencer Automatic Machine Screw Co., of Hartford, Conn., recommend their double turret screw machines, which finish the work complete, while other machines leave one end to be done by hand.

The Garvin Machine Co., Spring and Varick streets, New York, have exceptional facilities for the performance of experimental work in the motor vehicle line. Their machine shop is one of the largest and best equipped in the United States, and their experience covers all classes of work. They are also very large manufacturers of machine tools, such as screw machines, lathes and other automatic machinery, which will form a necessary part of the equipment of a motor vehicle factory.

New Barnes Drill.

The accompanying cut shows a new 26-inch drill, which the W. F. and John Barnes Co., Rockford, Ill., wish to call the attention of the motor vehicle trade to.



In this tool will be found an entirely new feature in sliding drills, namely, a combination lever, wheel and power feed.

With this arrangement of feeds a drill is secured that has the range and capacity of work required in both a stationary and sliding head drill of the same size. For a more detailed description the reader is referred to a pamphlet which the company will send on application.

Trade Publications.

A model of trade literature is the catalogue of the Ball Bearing Co., Boston, Mass., fresh from the press, and brim full of practical data on ball and roller bearings for all purposes. The flexible cloth cover bears in front a striking title page, the central figure of which is the infant daughter of the general manager, W. S. Rogers. Within will be found more practical information on the subject of which it treats than can be learned from any other source. A particularly valuable feature is the tables of conversions of measurements expressed in inches and millimeters. The important place which the motor vehicle axle and bearing now hold in the business of this enterprising concern may be judged from the fact that seven full pages are devoted to the various kinds of bearings manufactured for this use. This is said to be the first really complete catalogue and price list ever issued by a company making a special business of manufacturing anti-friction devices.

LESSONS of the ROAD

Users of motor vehicles are invited to contribute to this department for the good of the industry.

PORT CARBON, Pa., March 23, 1899.

Editor HORSELESS AGE.

DEAR SIR: I note the invitation in your March number to users of motor carriages to give their road experience. The writer is the owner of a gasoline motor carriage, and during the summer of 1898, in company with my wife, I ran off 1,100 miles, on all kinds and conditions of roads, made a trip to Philadelphia, 100 miles, and a trip of some fifty miles into New Jersey. Touring in a motor carriage is delightful as well as amusing. The experiences on the road are varied and something ridiculous, as you meet all kinds of animals, from the old farm horse and spirited driving horse to the two-legged road hog. I found as a rule most horses will shy at the carriage, but seldom to such an extent as to be dangerous. When I am on the road and meet a team that shows any symptoms of fear, I run to one side as far as possible and stop; if the horses still seem nervous, I stop the motor till they pass. I generally find this plan effective, and have not had any accident. One trouble with drivers is that when they meet a motor carriage they are so surprised and look at it so intently that they neglect the team they are driving, and get into trouble. A case in point occurred when I met two men slightly under the influence of liquor. The horse they were driving looked as though a bolt of lightning would not move him, but the men were so interested in looking at the motor that they let the horse take care of himself, the consequence being that the horse backed them over a slight embankment; both men jumped out and let the horse go. He ran a short distance, turned around and came back, meeting the men, who got into the carriage and went on their way rejoicing, no damage being done.

I make it a rule when meeting ladies driving, to get as far to one side as possible and stop, and should there be an embankment on the left side of the road I take that side, and signal the driver to take the high side, so as to avoid any possibility of the horse going over the embankment. I find this plan quite effective, and as a rule, drivers are glad to co-operate in it. It is quite amusing when you meet a man and a woman driving a horse, to see them both jump out, the woman getting as far out of the way as possible, and the man grabbing the horse by the head and holding on like grim death, and when the motor carriage passes and the horse does not even blink his eyes or move a peg, the whole outfit looks so sheepish that you cannot help laughing at them. It is also quite amusing when you travel on toll roads, for toll gate keepers, as a rule, have not seen motor carriages, and are at a loss what to charge. In one case the gate keeper looked at the wheels, and as they are similar to bicycle wheels, she decided the proper thing to do was to charge bicycle rates: one gate keeper on the Lancaster pike was so interested in the carriage that she forgot to collect the toll, and did not discover her mistake until I was some distance away, when she excitedly shouted to me to hold up.

When, touring in a motor carriage, you strike a town and

stop for refreshments or rest, as a rule the whole population will turn out, surround the carriage, and ask all kinds of questions. If you have climbed a steep hill to get to the town, one of the first questions will be: Can you run up hill? Or, if you have run down a long hill into the town, some one will ask, How do you manage to get down a hill? Don't the machine run away and smash up? or, What do you do when you want to turn around? etc., etc.

On our trip to Philadelphia, we stopped in Pottstown over night. I put the carriage in the hotel stable, and gave the hostler permission to show it to any interested persons. He told me next morning that he was kept busy until after 12 o'clock showing it, and then had to lock the door, and refuse to admit any more people. This was the case wherever we went. In Reading we were surrounded by great crowds of people whenever we stopped, and it was almost impossible to get out of the crowds without accident when leaving.

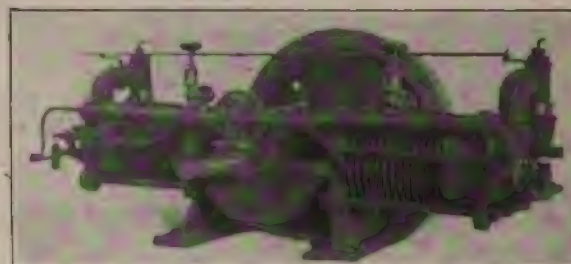
We spent three weeks in Philadelphia, and if you think it would interest your readers, I would be pleased to give my experience in the crowded streets of the city.

Yours truly,

MOTOR.

A Mexican Gasoline Motor.

Mohler & DeGress, Mexico City, Mex., have built three motor carriages, one of which, propelled by a 6 H. P. gasoline motor, Mr. Mohler recently brought with him to Mechanicsburg, Pa. In this carriage he is now placing gearing with friction clutches direct in gear wheels, as the French method of changing speed by meshing the gear teeth while in motion proved unsatisfactory. Mr. Mohler states that they will hereafter confine their output to double cylinder gasoline motors and the transmission mechanism for the trade, as complete carriages cannot be made to advantage in Mexico.



One of the types of motor which they manufacture for the trade, depicted here, weighs 275 pounds, and is especially applicable for delivery wagons. It is 41-2 by 41-2, and is governed either on the hit and miss principle or by throttling as desired. The cylinders are made of steel tubes, aluminium or cast iron, the latter being preferred by the makers.

Another type of vehicle motor which they are producing is shorter than the above, with valves placed in valve boxes on the side of the cylinder and cranks entirely encased. This type is made in 4 and 6 H. P.

The above motors represent the experience derived from no less than twelve different motors, built and abandoned.

MOTOR VEHICLE PATENTS

of the world

EDITED BY W. H. GRAHAM.

618,915—Motor Vehicle—C. Sterling, February 7, 1899.

The invention lies mainly in a device for producing variable speeds consisting of a number of pairs of gears (11, 12, etc.), all of different sizes, and loosely mounted upon two shafts, one 4, operated by the motor, and the other 16, in gear with the driving wheel axle. Each pair of gears is of such relative pitch diameter as to transmit rotation at different speeds from the motor driven shaft to the axle driving shafts. Each member of each pair of gears is adapted to be rigidly connected to its respective shaft by clutch mechanisms operated, when required, by the continuously moving shaft 4. This shaft may be placed in and out of gear with cam shafts

Fig. 2.

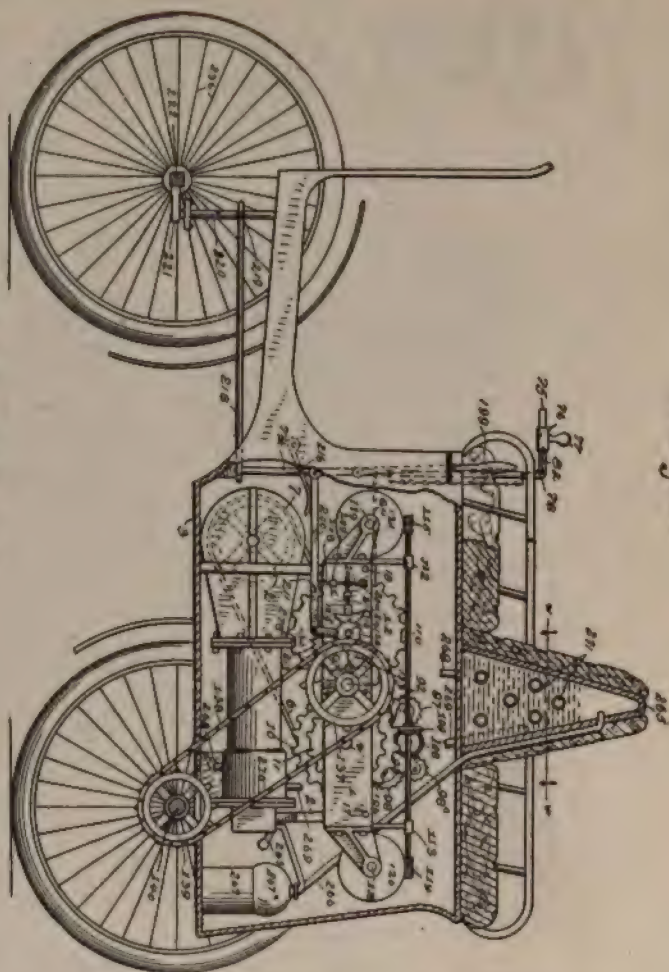
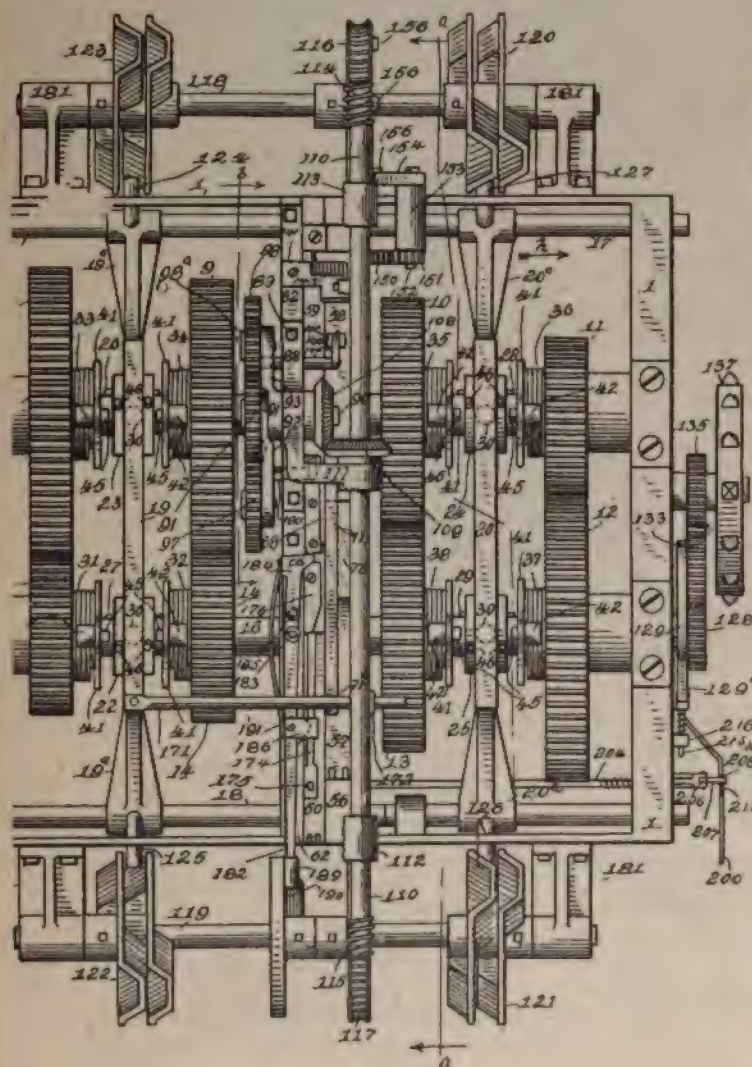


Fig. 1.

118, 119, having cams adapted to place the clutch devices successively in and out of action until the pair of gears giving the desired speed is placed in operation.

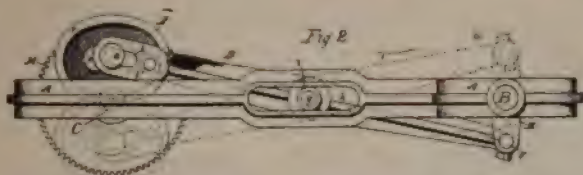
Means are also provided for reversing the motion transmitted to the axle by a separate hand lever, 199, which controls the gearing between the shaft 16, and the axle driving sprocket 136.

The vehicle is steered by an ordinary handle, 75, upon which is placed a reciprocating block, 76, adapted to regulate the speed of the vehicle by operating mechanism for placing the cam shaft in and out of gear with the motor driven shaft, and for causing its rotation in either direction.

The motor shaft is started by a spring normally held in tension and adapted to rotate two grooved friction driving pulleys that may be placed in and out of engagement with the motor balance wheel, the continued motion of which, after the motor has started, serves to return the power of the released spring and to place it again in tension.

618,922—Device for Transmitting Motion—J. G. Wagner, Jr., and H. S. Searle, February 7, 1899.

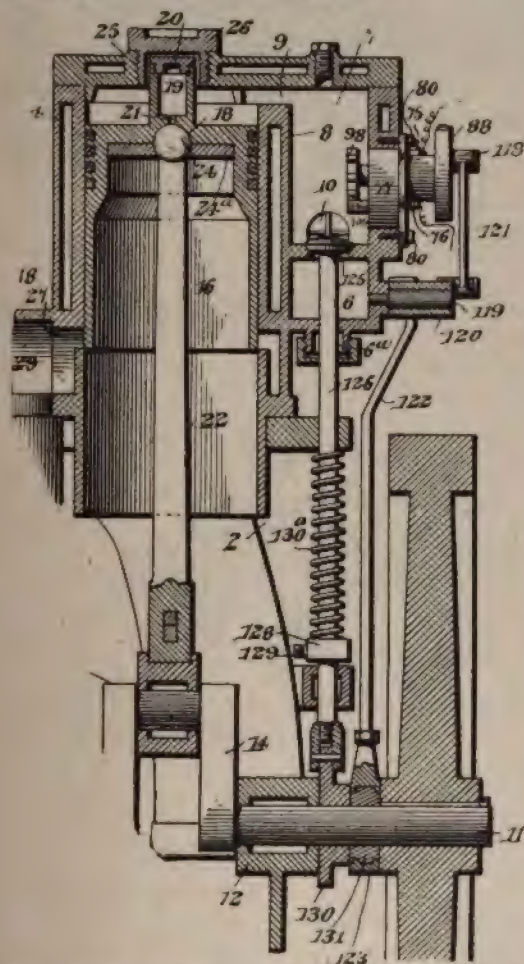
The object of the invention is to transmit a uniform rotary motion from one shaft to another parallel shaft, by means of a connection rod, or pitman D, pivoted in slots in a double frame A, suspended between the shafts. The pitman is attached to the driving shaft B, by the usual crank and pin, and to the driven shaft C, by a crank pin traveling in a longitudinal slot in the end of the pitman. Near the inner end of this slot is a stud 1, traveling in a cam race 4, cut in the face of the crank. The action of the parts is to transmit a uniform motion.



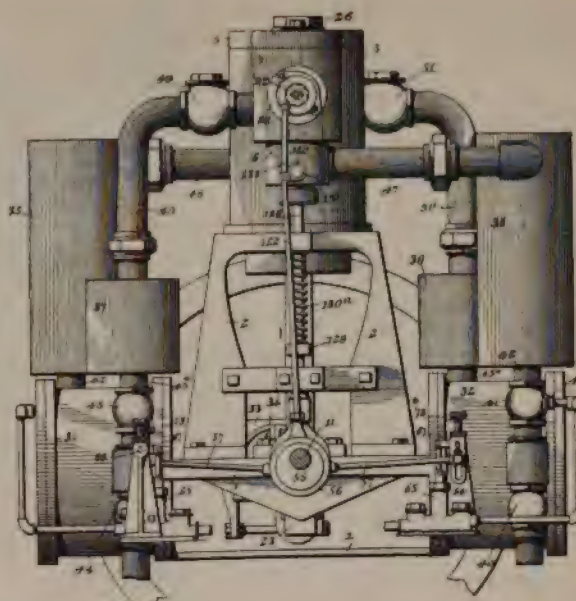
The more important claims are for means for moving the connection rod independently and at different speed from the driven shaft to compensate for the irregular motion of the driving end of the pitman.

618,972—Gas Engine—C. R. Alsop, February 7, 1899.

As stated by the inventor the invention consists of means by which each compression-cylinder is flushed with a charge of atmospheric air, following the exhaust of the exploded and spent charge, and prior to the admission of a fresh explosive charge; in an improved pump for forcing gas or gasoline into atmospheric air under pressure to produce the explosive charge to be supplied to the compression-cylinder, and in an improved means for lubricating the joint between the piston-head and the piston-rod.



The crank operates by means of an eccentric 34, two double-acting air pumps 31 and 32, each of which at every stroke forces air into one of two tanks or reservoirs, 35, 37, and 36, 38, which are in communication with the pump. One tank, 37, 38, supplies air for flushing one cylinder when the pressure therein is released on the opening of the exhaust port, 28, by the outgoing piston, while the other reservoir, 35, 36, serves



as a mixing tank for producing the explosive gases from the incoming air and a supply of fuel forced into the air supply pipe by a pump, 54, operated from the crank shaft. Each pump, 31 and 32, supplies air for flushing one cylinder, and the explosive mixture for the adjoining cylinder. The stroke of each pump is timed to produce a maximum air pressure upon the opening of the cylinder exhaust, and when a cylinder is filled with air the supply thereof ceases, and the explosive charge is admitted through a positively operated valve, 125, the last quantity of air being driven out as the exhaust closes and the piston begins to compress the explosive mixture. An electric igniter is shown and described.

Separate supplies of air, under intermittent pressure, are indispensable for each cylinder, but a common supply of explosive mixture may be employed for both cylinders.

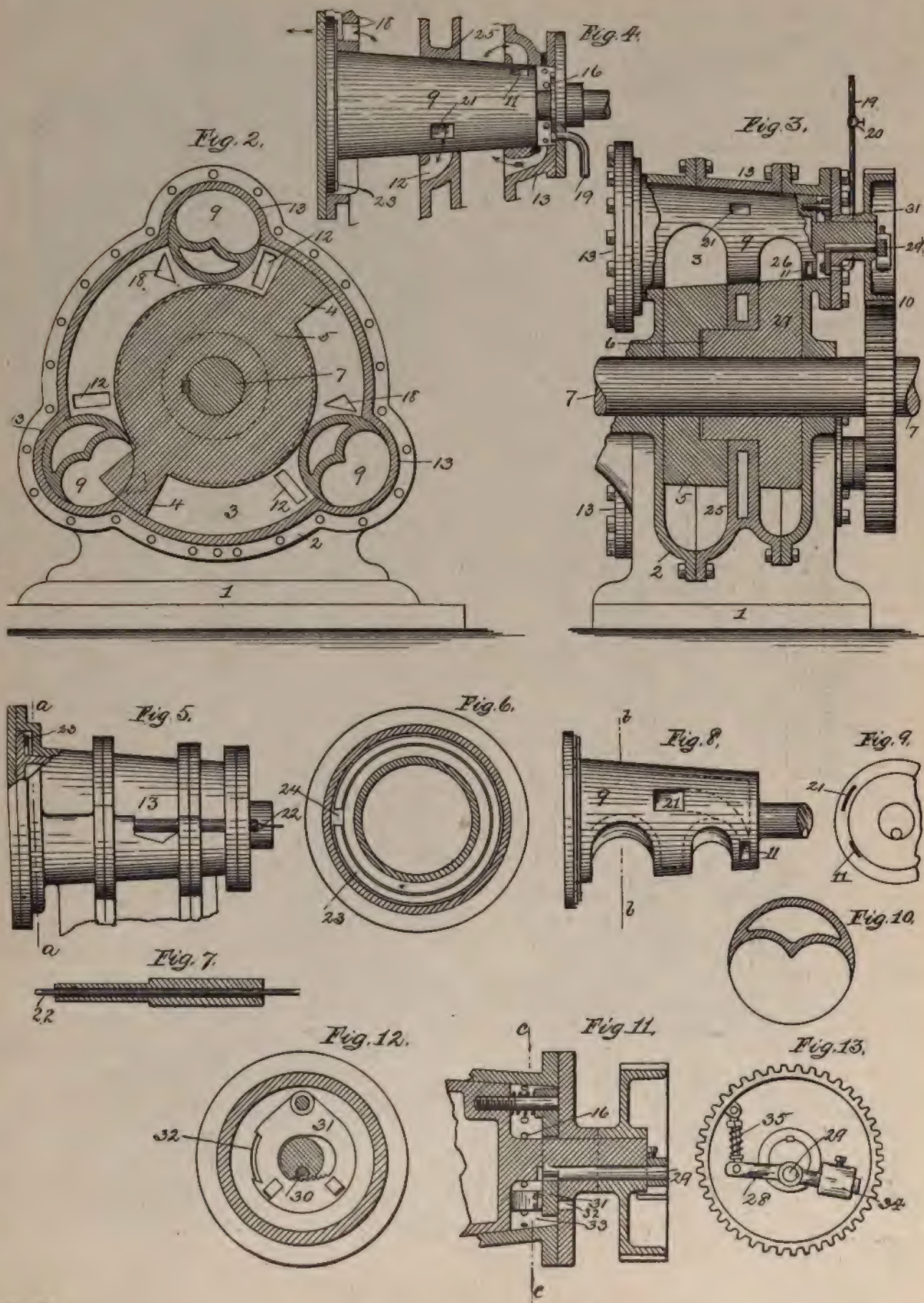
The apparent patentable features of the invention are the means for producing the supply of air and explosive gases in the peculiar manner described, together with a combination of the mixing chambers and the pump for supplying the air and fuel, respectively.

The bearing of the connecting rod in the piston is lubricated by oil from a small closed receptacle, 19, on the inner side of the piston, and adapted to be refilled by removing a cap, 36, in the cylinder head. This improvement is claimed.

619,004—Rotary Internal Combustion Engine—J. W. Tygard and P. L. Tygard, February 7, 1899.

Briefly stated, the invention consists in providing two annular chambers, each containing traveling pistons, which, in the first chamber, draw in and compress an explosive mixture, and by means of valves common to both chambers deliver the mixture between the closed valves and traveling pistons of the second chamber, wherein it is ignited and exploded for propelling the pistons in the latter chamber.

A stationary case is provided with a circumferential annular explosive chamber, 3, containing two diametrically opposite pistons, 4, adapted to travel therein. The pistons are mounted on a hub secured to a concentric shaft, 7, supported in bearings, 8, so that the travel of the pistons, 4, will cause the shaft to rotate. Arranged equidistantly and across the annular chamber, 3, and pathway of the pistons, 4, are a number of valves, 9, connected by a suitable gear wheel, 10, to the



TYGARU ROTARY INTERNAL COMBUSTION ENGINE.

shaft, in order that the valves may rotate and open the annular pathway to permit the pistons to pass and to close the annular space immediately thereafter. These several valves are hollow, and by lateral openings, or inlet ports, 11, 21, momentarily communicate with the annular chamber, 3, directly behind the pistons, 4, as they pass corresponding side openings, 12, formed in the walls of the annular chamber. Each valve, 13, is provided with a fuel pipe, 19, having a cock, 20, and with openings, 16, for the admission of air to form an explosive mixture with the fuel gas.

At equidistant points through the walls of the annular chamber, 3, are formed ejection ports, 18, for the escape of waste products of the successive explosions.

The igniter is situated in the valve casing, 13, and consists of a contact breaker, 22, traveling upon a contact ring, 23, in connection with the valve and formed with a break, 24, to produce an electric spark at regular intervals.

Connected to the structure previously described and separated therefrom by a partition, 25, is an adjoining annular chamber, 26, containing two pistons similar to those just described and attached to the shaft, by which they are driven. The valves being common to both of the annular chambers, move with relation to their respective pistons in the same manner and successively, the gearing causing each valve to revolve twice during every revolution of the shaft. These pistons, after passing the valves, serve to suck or draw the gas and air behind them into the annular chamber, 26, until the next valve is passed and closed, after which the following piston, as it approaches the front of the valve, will compress the explosive mixture, and then force it through the lateral opening, 10, into the annular explosive chamber, 3, as the valve is turned for the passage of the piston. As the valve is closed behind the departing piston, in the explosive chamber, the explosive charge is ignited, producing an explosion which gives to the piston the desired impetus, and the products of explosion, after expanding, are driven through the exhaust, 18, by the succeeding piston.

As the pistons approach and pass the several valves in rapid succession, each valve operates with respect thereto, to introduce the explosive mixture, which is then ignited as described. As there are only two pistons in each annular chamber, and three separate valves common to both pistons and located equidistant in the pathway of the pistons, the several valves operate at different periods, in accord with the relative positions of the pistons, so that the successive explosions are not synchronous with the rotations, thereby securing a more uniform motion. The invention seems to be capable of employing any number of pistons, providing the number of valves is greater.

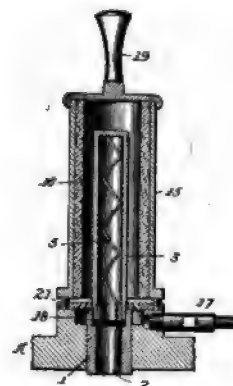
The gas supply is controlled at each valve casing by a governor, consisting of a bar, 28, pivoted near its center upon one end of a short shaft, 29, eccentric to the axis of the valve. The opposite end of the shaft, 29, being provided with a small pinion, 30, engaging teeth formed in one edge of a pivoted plate, 31, adapted to open and close the gas passage, 32, leading into the valve chambers. The bar is provided at one end with the usual centrifugal weight, and at the other end with a spring for keeping the gas inlet normally open.

The inventors claim broadly the first annular chamber for preparing the explosive mixture, in combination with its rotary pistons for compressing and forcing the charge into an adjoining annular explosion chamber, also containing traveling pistons, with means for igniting the charge for driving the pistons. This combination is enlarged in the following claims, so as to include successively the drawing in of the

air and fuel, the automatically operated valves, the succession of explosions, the alternate operation of the valves in transmitting the explosive charges, and in opening the passage for the pistons, the inlet and outlet passages, the admission of the compressed charge between the valve and the departing pistons, and finally the governor.

The motor illustrated by the drawings is provided with conically shaped co-acting piston hubs and valves. The reason for this construction is not apparent, and although it may be a simple method of obtaining the desired relative sizes of the annular chambers, yet the tendency to wear and subsequent leakage may be found to be greater than in the plain cylindrical type. In view of this defect in all existing types of low speed rotary motors, particular attention should be paid to these considerations in designing a machine of this description. No means for packing or taking up the wear is indicated, and the bearing surfaces between the various compartments appear to be small, especially at the contact of the valve with the piston hub.

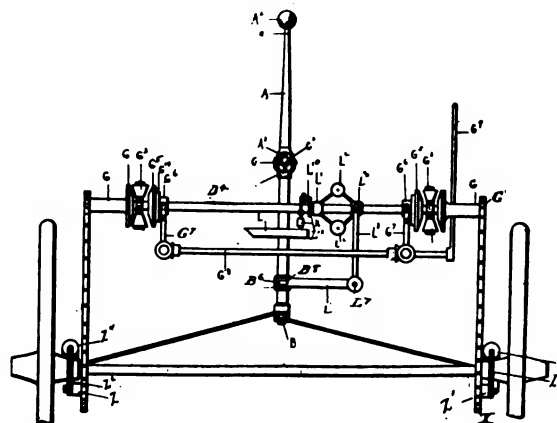
619,396—Igniter for Gas Engines—W. L. Crouch, February 14, 1899.



The ignition tube, 3, is surrounded with the usual chimney, 16, provided with a burner, 17, which serves to heat to incandescence a thin strip of platinum or other suitable metal supported in the ignition tube. After the burner is turned off the platinum strip is maintained at a high temperature by the successive explosions in the cylinder. It thus serves as an igniter without the aid of external heat.

619,505—Motor Vehicle—G. L. Roby, February 14, 1899.

The invention consists partly of a handle steering bar, A, containing a secondary shaft adapted to be rotated by a knob, A2, and by means of a threaded lower portion, to raise or lower a block, B6, which is connected by series of levers



and rods to the sliding collar, L3, supporting the governor weights in conjunction with the collar, L1, both carried on the main or auxiliary shaft, D4, of the motor. By rotating the knob, A2, the collar, L3, is moved on a shaft to change the position of the weights, and therefore, to alter the speed at which the governor is operated. The collar, L1, carries a cam operating a plunger of a pump, K, that acts to force the successive charges of fuel, etc., into the feed pipe, L, of the motor. The function of the governor is to disengage the cam from the pump plunger, so as to stop the supply of the fuel to the motor.

A driving sleeve, G, is normally held by an interior spring in engagement with a dog (not shown) upon the shaft, D4, and is disengaged therefrom by a frame carrying the idle pinions, G3, which is moved along the shaft to disengage the dog from the sleeve and to mesh with a gear formed on the face of the driving sleeve. The movement of the frame is obtained by a spring, interposed between the frame and a sliding gear, G5, splined to the shaft. The further movement of the gear, G5, brings it into engagement with the driving sleeve by means of the intermediate pinions, G3, thereby reversing the rotation of the sleeve. The gear, G6, is moved by clutch levers, G7, attached to a handle, G9, through a system of levers and rods.

The invention also consists in an elastic connection between each driving axle sprocket, X, and the hub of the wheel. This is obtained by attaching to each hub a curved air cylinder, 24, which contains a piston rigidly connected to the driving sprocket. With this construction the inventor claims that all sudden accelerations or retardations of motion are yielding and gradually transmitted from the motor to the wheels, and vice versa.

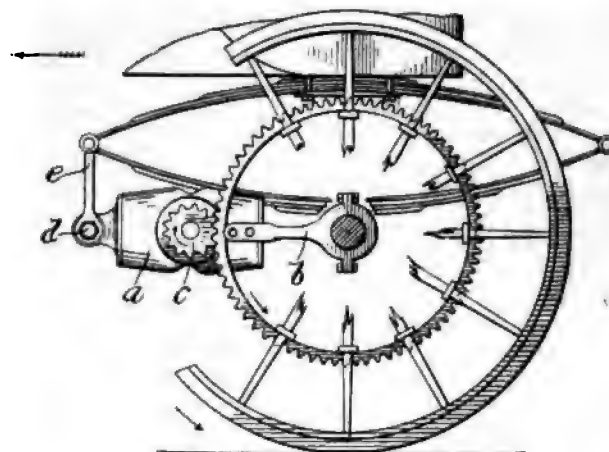
Means are also shown and claimed for continually taking up the slack of the driving chain, consisting of two loosely mounted rollers adapted to be rocked in opposite directions against the chain by the downward movement of the vehicle body.

The structure of the steering and speed regulating post is claimed to be novel, as described herein, together with the means for transmitting its motion to vary the speed of the motor. A claim is made for "the combination of two collars sliding in suitable guides upon the main or auxiliary shaft of the motor, which are connected by flexible arms to each other, one of said collars being attached to the speed regulating lever thereof and the other to a cam," capable of carrying the operation of "the piston of a pump, injecting explosive liquid into the air-duct of the motor." The claim also includes the details of the pump, in which the valves are directly and positively operated by the plunger; the reversing gear substantially as described herein; and an elastic cushion of air or other gaseous substance interposed between the motor and the vehicle driving wheel by "confining it in tightly-closed cylinders at varying densities."

619,527—Motor Vehicle—C. E. Woods, February 14, 1899.

Briefly stated, the invention consists of a motor vehicle having a spring support or supports adapted to subserve the double purpose of flexibly supporting the vehicle-body and motor, the motor being preferably provided, as in prior constructions, with a pivoted mounting at one end coaxial with the gear-wheel directly engaging the driving wheel of the motor, the other end of the motor being united with the common flexible support.

Two motors are preferably employed, those illustrated being enclosed electric motors having extensions, b, by which the motors are rotatively suspended upon the gear shaft. Each



motor, a, carries a spur driving pinion, c, engaging a corresponding driving gear, mounted upon the adjacent rear wheel. The motors are further held in position by a connecting rod extending between them, and rigidly attached to both. The usual elliptic springs are interposed between the vehicle body and the axle, and each motor is united by a rigid link, e, to the contiguous end of one spring, it being seen that a single elliptic spring supports each motor. By this construction the vehicle body is permitted the requisite wide range of motion, and the motor, while relying for its support upon the same spring that supports the vehicle body, has a much smaller range of movement. It is claimed by the inventor that by attaching the motors to the ends of the elliptic springs, the vehicle bodies and motors may have the ranges of movement to which they are peculiarly suited, and by giving the motor a spring mounting, the sudden impact or violent engagement between the cogs of the gear wheel during the running of the vehicle, is prevented.

A modification is shown, in which each motor is supported from the center of a semi-elliptic spring, and from the vehicle body, in addition, by means of a strap and buckle. By this latter construction a direct downward pull is exerted by the motors upon the wagon body, through the medium of the straps, this downward movement being also resisted by the semi-elliptic springs. When the motor is started to move the vehicle forward, the springs yieldingly limit the tendency of the motor to move upwardly.

The claims are for a flexible support of a vehicle body composed in part of an elliptic spring, and a motor in engagement with the running gear of the vehicle and flexibly supported by a movable part of the elliptic spring; also for the foregoing in combination with a rigid connection between the motor and spring; the motor gear wheel and the axle gear wheel, the motor with its gear wheel being rotatively suspended upon the rear axle. The independent connection of each motor, with its respective support, is also claimed.

The novelty seems to lie in the suspension of the motor on the one hand by a rigid connection to a semi-elliptic spring, or one end of a full elliptic spring, and on the other hand by a rotative connection to the rear axle, the transmitting gear being adapted to be in operation during rotation.

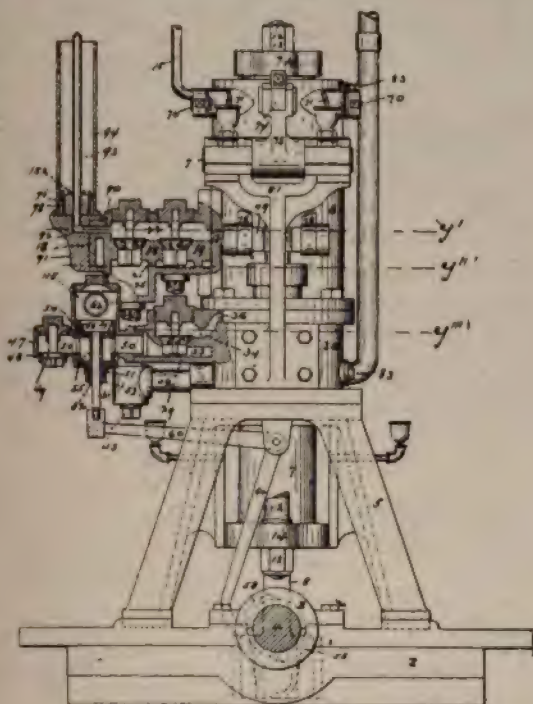
619,776—Gas Engine—P. Murray, February 21, 1899.

The patent describes a gas engine carrying a single cylinder casing, 6, open at both ends, and divided by a transverse partition, 9, into two separate cylinders, each having a piston, 7, and arranged to be single acting, as in the ordinary type, the

impulse of one piston being in the opposite direction to that of the other, so that taken together, the cylinders supply the essential of a double acting engine.

The main interest of the invention lies in the attempt to produce a successful "unicycle" gas engine, and to provide an explosion at every outgoing stroke of each piston. Accordingly, the inventor has provided a device for driving the exhaust gases from each cylinder by a charge of air admitted through a non-return valve, 28, at the moment the pressure in the cylinder is relieved on the opening of the exhaust port, 83, by the piston approaching the limit of its outward stroke. The air is then forced out by the admission of the explosive mixture, which fills the cylinder as the exhaust closes, and the piston begins to return to compress the charge.

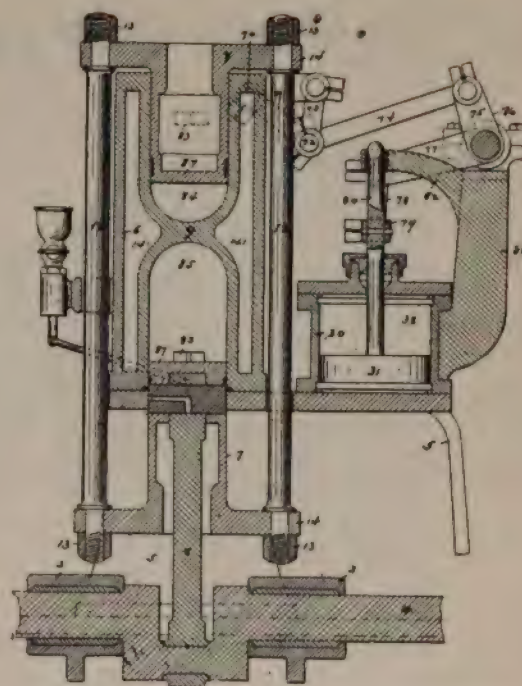
The quantities of air and explosive gases are successively forced into the cylinders of a double acting pump, 30, adapted to circulate each gas separately on one side of the piston, which is reciprocated twice for every reciprocation of the



engine, in order that each cylinder may be supplied with the necessary number of charges of air and the explosive gases. The motion of the pump is timed so as to supply one cylinder with the air and gas charges while the other cylinder is under such pressure as to prevent any admission of gas. The pump is operated by a bell crank lever, 77, attached to a toggle, 71, 74, which is connected by a link, 73, to one of the reciprocating rods which couple the two engine pistons together.

The explosive mixture is produced by the action of the pump in drawing a current of air into the mixing device, 47, into which is admitted intermittently quantities of fuel gas through a valve operated from the crank shaft by means of a cam rocked lever, 60, which is placed in and out of engagement with the cam by means of a centrifugal shaft governor.

No positively operated valves are employed, with the exception of the fuel admission valve. The desired operation of the apparatus is dependent upon the relative periods at



which the explosive mixture and air from the pump, and the gases in the cylinders, are released or compressed. The novelty of the invention seems to consist mainly in the double power cylinder co-acting with the double acting pump, the means for operating the pump, and the apparatus for conveying and controlling the charges of air and explosive gases. Many details of construction not herein described are included in the claims, fifty-three in number.

A carburettor is shown and claimed, situated around the chimney of the ignition tubes. A valve in the carburetting chamber adapted to be opened by the suction of the pump, engages with the spindle of a liquid fuel inlet valve at every stroke, so as to admit a quantity of fuel to be vaporized.

The inventor has a claim for "the process of preventing premature explosion or ignition of explosive gas in a gas-engine, which consists in interposing a charge of non-explosive air between an explosive charge of gas and the product of a previously ignited charge of gas, substantially as set forth."



620,166—Automobile Vehicle—M. F. McAnelly and E. F. Williams, February 28, 1899.

The invention relates to automobile vehicles for traversing land, water, snow or ice, and consists of a boat-shaped body containing a transverse driving shaft, carrying two spiral motor springs, adapted to be wound by hand and to be placed in and out of engagement with the shaft. Two traction wheels at the rear of the vehicle are geared by chains to the driving shaft. A device for driving the shaft by hand is also shown.

846838A

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WESTON-MOTT COMPANY.

UTICA, N. Y.

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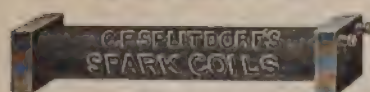
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SPECIAL NOTICES.

Advertisements inserted under this heading at \$2.00 an inch for each issue, payable in advance.

For Sale--A Winton Motor Carriage

At a bargain, 1898 model, used about six months, recently rebuilt. Can be seen and tested by appointment.

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Cleveland, Ohio.

A GAS ENGINE.

Advertiser has control of American rights of a Gas Engine of foreign patent and which is admittedly the best on the market. Will consider a proposition to form company, or accept royalty, or sell all rights. Address GAS ENGINE, care THE HORSELESS AGE.

FOR SALE.—TRACTION WHEEL PATENT.

issued May 12, 1896, No. 559,866, the only thing yet invented that prevents motor vehicle wheels from slipping on snow, icy or muddy roads. Address D. L. REAGEN, General Delivery, Roxbury, Mass.

FOR SALE.—WINTON MOTOR CARRIAGE in

good condition. Has been run less than 2,000 miles. Price, \$650.00. ST. LOUIS MOTOR CARRIAGE CO., 1112 Olive Street, St. Louis, Mo.

FOR SALE.

A second-hand Duryea Motor Carriage. Price, \$450.

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WANTED.—Bids on the Construction of a Motor

Vehicle, from drawings finished to a scale, and also on same vehicle in quantities. Also wish to purchase the best actual 6 H. P. Gasolene Vehicle Motor on the market. Address, HORSELESS AGE, 150 Nassau Street, New York City.

WANTED.—By Mechanical Engineer and business

man having had long experience in selling, designing and manufacturing steam, gasolene, and electric devices, a position where he can develop important improvements in motor carriages. Address, INGENIEUR, care HORSELESS AGE.

Wire Spokes

for Motor Carriages, Sulkies, Multi-Cycles and Bicycles, swaged from special steel prepared for and adapted to this purpose. We make any size and length required from wire one-quarter to one-sixteenth inch diameter.

Write us for prices on what you want.

THE WIRE GOODS COMPANY, Worcester, Mass.

VOLUME 4

APRIL 12, 1899

NUMBER 2

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EVERY WEDNESDAY

In the
Interest of the
Motor Vehicle Industry.

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NEW YORK.

Something About Liquid Air.
pp. 5 and 8.

the number at work when the inspector entered) francs in all, which may be regarded as an expression of the court's opinion of the law of 1848.

The Count said that he would forward the protest of his workmen to the President of the Republic and do his utmost to bring the matter before the Chamber of Deputies.

The motor vehicle industry is destined to reveal the inadequacy of many laws which are intolerable to its swift and vigorous growth. Laws which impede its progress must be repealed.

Electricity vs. Gasolene.

Rivalry between the gasolene and electric interests is running high in Buffalo, N. Y., where a franchise has recently been granted a company to run public vehicles in the park. It is reported that the gasolene system has been adopted by the successful applicant for the franchise, and the electric interests show their hand in an editorial of a local newspaper, reciting the alleged dangers and discomforts of the gasolene system, while in retaliation the adherents of gasolene, in another local daily, refer to the showing at the recent motor carriage festival at Nice, France, when, out of seventy vehicles on parade sixty-nine were propelled by gasolene motors and one by steam, electricity not being represented at all. Of course, there was need of further explanation in both cases to arrive at just conclusions, but in the keen rivalries of business these explanations are omitted.

How to Meet a Frightened Horse.

A veteran subscriber of THE HORSELESS AGE, owner of a motor carriage which he has run thousands of miles over country roads, has some valuable advice to give the novice in regard to the best way to approach a frightened horse on the highway. If the operator of the motor carriage and the horse both become frightened, he says, trouble will surely result. "The bold way is the best way in such an emergency. Do not stop your carriage and keep it standing in front of the frightened animal to add to his terror, but press on at good speed, giving the horse plenty of roadway, and before the perturbed beast can do any damage the motor carriage will be beyond his ken, and he will realize the folly of his performance." Points like this will make our "Lessons of the Road" department a real boon to the beginner.

We call special attention to the description of a very simple sparking device in our "Lessons of the Road" department. It is such practical suggestions as this, gleaned only from experience, that are most desired by the editor, and are most instructive to all. For simplicity and cheapness the method devised by Mr. Lyon seems to be superior to those now in general use. The phial of solution necessary to restore the spark is so small as to be of no inconvenience, and the fact

that the materials composing it can be had at any drug store is unique as regards sparking devices.

Two New Carriages on the Pacific Coast.

The carriage shown here is the latest product of W. L. Elliott, Oakland, Cal., whose first effort was illustrated in our columns about two years ago.



GASOLENE CARRIAGE OF W. L. ELLIOTT.

The 4 H.P. gasolene motor has two cylinders, and will run the vehicle at a speed of 18 miles an hour on level roads, and drive it up a 15 per cent. grade at 4 miles an hour.

J. A. Meyer, 1415 Twenty-fourth street, San Francisco, Cal., foreman for the J. L. Hicks Gas Engine Co., has constructed for himself a gasolene carriage weighing 800 pounds, and said to be capable of a speed of 18 miles an hour.

The motor, which weighs 200 pounds and develops $3\frac{1}{2}$ H.P., is placed under the rear seat.

Electric ignition is used.

Ready for the Race.

BOSTON, MASS., April 22, 1899.

Editor HORSELESS AGE:

In reply to Mr. A. Fischer, who accepts my challenge to run a motor tricycle contest from Boston to New York, I must ask Mr. Fischer to put no such stipulations on the contest as he asks for, such as simplicity, noiselessness, etc. I consider this absurd. If he wants separate contests for simplicity, manageability, noiselessness, etc., all well and good. In horse races, bicycle races, etc., it is the one that gets there first that wins. I admire Mr. Fischer's pluck in accepting the challenge, but there must be no such restrictions as he asks for. Let it be simply a speed contest, and let other contests follow separately if he desires. I am ready to arrange the match at once, and if it is not convenient for Mr. Fischer to come to Boston to arrange the date, etc., I will go to New York. Yours sincerely,

KENNETH A. SKINNER.

United States Agent for De Dion-Bouton Co.



ELECTRIC BROUGHAM OF THE GENERAL ELECTRIC AUTOMOBILE CO., PHILADELPHIA.

From the De Dion Champion.

Editor HORSELESS AGE:

As I am the sole representative in the United States for the De Dion-Bouton Co., of Paris, France, I feel it my duty to reply to the article in your last edition on "The Gasolene Vehicles." It is said that without doubt the American Automobile Co.'s tricycle is in many respects superior to the De Dion-Bouton; that it is lighter, etc. In reply to that, I will say that a few years ago the De Dion Co. made a motor tricycle that weighed only 140 pounds, but they soon found out it would not stand the strain over rough country roads, and built them stronger, as they considered it better to add a little weight and have a safe machine. When the American and other companies test their tricycles as the De Dion-Bouton Co. have theirs, they may find out that it is better to build them a little stronger and avoid accidents. When they will have placed 14,000 motor tricycles in the hands of the public, as the De Dion-Bouton Co. have, all over the world, then they will learn much by practical experience. It is a well-known fact that the De Dion-Bouton Co. have been at work on their motor tricycles for the past fifteen years, that they are the originators of the motor tricycle, in fact, and that a great many persons are trying to imitate the De Dion-Bouton motors and tricycles all over the world, in the United States as well as in other countries. They buy a De Dion tricycle and copy it as near as the law will allow them, and some have even gone further, but the Count De Dion says.

"I will leave them alone until they make a good copy, then I will see what the law will do to protect my patents. Up to the present the copies are so bad I let them alone to spend their money experimenting."

We all know that improvements can be made on the best of machines. The De Dion Co. are making improvements all the time. Nearly all their machinery is up-to-date American machinery. The De Dion tricycles have won all the principal contests up to the present time, and I consider it a little premature to claim any superiority over it for untested machines of any make. In the interests of fairness and justice, I trust you will insert this in your next issue.

Yours sincerely,

K. A. SKINNER.

To Promote the Lewis Patents.

The Lewis Motor Vehicle Co., organized recently in New Jersey by Philadelphia capitalists, to promote the patents of George W. Lewis, Chicago, Ill., is officered by some of the leading financiers of the Quaker City. The president is Walter E. Graham, head of the Philadelphia Lawn Mower Co., the largest makers of high-grade lawn-mowers in the world; the first vice-president is Thos. W. Synott, president of the Glassboro National Bank, and connected with the Whitney Glass Works of New Jersey; the second vice-president is J. B. Woodward, vice-president of the Tenth National Bank, of Philadelphia; the treasurer is Charles H. Graham, a retired capitalist of Philadelphia; the secretary is D. G. Clarke, busi-

ness associate of W. E. Graham. Besides these men, the directory is made up of R. B. Berwind, head of the wholesale coal firm of Berwind, White & Co.; E. T. Postlethwaite, of the Pennsylvania Railroad, and Harrison Snyder, of the well-known brokerage house of Harrison Snyder & Son.

The parent company is capitalized at \$5,000,000, of which \$500,000 is preferred stock in the treasury, and \$4,500,000 common stock, which will be listed shortly on the Philadelphia and New York Stock Exchanges. Sample wagons are being constructed, and it is the purpose of the company to organize auxiliary companies throughout the United States, paying royalty to the parent company.

The inventor is Geo. W. Lewis, of Chicago, one of the entries in the *Times-Herald* race, and the owner of many patents on gasoline motor vehicles taken out since that event.

"Horsey" Horseless Carriages.

Uriah Smith, of Battle Creek, Mich., believes that the greatest impediment to the general use of motor vehicles is the fact that some horses, particularly those in the country, are frightened by them. To obviate this danger he has devised the form of carriage shown in the illustration, having the front portion terminating in the shape of a horse's head and neck. This expedient, he thinks, would allay the fears of any equine, for



to the head on approach "it would have all the appearance of a horse and carriage, and hence raise no fears in any skittish animal; for the live horse would be thinking of another horse, and before he could discover his error and see that he had been fooled, the strange carriage would be passed, and then it would be too late to grow frantic and fractious."

The inventor also recommends this device as a wind break and as a receptacle for gasoline.

Motor Carriage at the Smithsonian.

The first experimental carriage of S. M. Balzer, New York, is now permanently on exhibition at the Smithsonian Institution, Washington, D. C. Mr. Balzer is making a twelve H.P. motor for Professor Langley's flying machine. The weight is said to be limited to 100 pounds.

LONDON NOTES.

Several new types of light motor-vehicles, to seat two or three persons, are on the stocks in Belgium. La Fabrique Nationale d'Armes de Guerre, of Herstal, near Liege, is building a two-seated carriage to weigh, complete, not more than 560 pounds. It is furnished with a 3 H.P. petroleum motor, located in the front portion of the vehicle. The ignition is electric and the cooling of the cylinder is effected by radial ribs. The transmission of power is by belts to an intermediary shaft and from the latter by ordinary sprockets and chains to the rear wheels. M. Peterill of Rue de Scorpion, Antwerp, is also about to introduce a new, light two-seated carriage weighing complete about 450 pounds, and to cost not more than \$600. The carriage will be fitted with a two-cylinder petroleum motor of French construction, known as the "Aster."

Public motor services are springing up at a rapid rate in both France and England. Only a few weeks ago the formation was announced at St. Etienne, France, of La Compagnie Stepanoise de Traction Automobile to start a service of motor-omnibuses in that district, and now comes the news that the new company has placed an order with the De Dion-Bouton Co. for five large steam omnibuses.

Fully half a dozen firms in France are now catering to the demand for small petroleum motors, suitable for motor-cycles. This movement is now spreading into England, both as regards cycle makers taking up motor-tricycle construction and motor builders supplying motors suitable for driving the same. One of the latest concerns in the latter class is the Motor Manufacturing Co. Ltd., of Coventry, who, in a circular just out, announce that they are now manufacturing motors of the latest De Dion type.

The Daimler Motoren Gesellschaft, of Cannstatt, Wurtemberg, has lately brought out several new types of carriages. One is a four-seated vis-a-vis; the frame and driving gear is on the standard Panhard-Daimler system, with the motor in front, the new departure lying in the arrangement of the seats. The company has also lately introduced a new type of carriage especially designed for the use of country doctors. It is a four-seated vis-a-vis, but the motor is located in the rear of the vehicle. The speed gear is arranged to give any desired speed from three to fifteen miles an hour, and grades of 15 per cent. can be ascended.

The construction of electric motor vehicles is being taken up by the Kolner Electricitats Gesellschaft (formerly Messrs L. Welter & Co.), of Cologne, Germany. They are establishing special works for the purpose and are advertising for an expert manager to take control of them from July 1st.

One of the latest English cycle concerns to take up the manufacture of motor-tricycles is the Star Cycle Co., Ltd., of Wolverhampton. They will use the De Dion motor.

Any American motor-carriage firm thinking of exhibiting its vehicles at the automobile show which is to be held in Paris in June, will be interested to learn that arrangements have been made with the French Customs authorities whereby foreign vehicles intended for the exhibition will be admitted free of duty subject to their being re-exported within a period of three months after the closing of the exhibition. If the vehicles are sold or kept in France beyond three months the duty will be claimed. It is also announced that French railway companies will carry motor vehicles intended for the exhibition at a reduced rate.

There are those in England who would like to see the ex-

ample set by Boston in excluding motor-vehicles from the Parks, followed as regards Hyde Park and the other royal parks in the London district. A few days ago a certain member of the House of Commons proposed that such a regulation be enacted. The Minister under whose control the parks are, in reply, expressed his inability to see how a private motor-carriage could be excluded from the parks simply for the reason that it was propelled by electricity or other power instead of being drawn by a horse.

The old-established firm of Sir William Bailey & Co., of Salford, Manchester, are taking up the construction of motor-vehicles. This firm have a long-standing reputation as manufacturers of pumps, boilers and engine fittings, etc., and have just acquired additional works near Salford in which to construct motor-vehicles, supposedly steam.

MINOR MENTION.

The Pope Manufacturing Co. will exhibit a full line of their motor vehicles at the Paris Exposition.

T. D. Wilkin, Syracuse agent for R. G. Dun & Co., has received his Haynes-Apperson carriage from the factory.

The White Motor Wagon Co. have leased a part of the plant of the Diamond Truck Co., Kingston, N. Y., and are constructing a carbonic acid wagon there.

George A. Burwell, superintendent of the Lozier works at Toledo, O., is the designer of a three-wheeled motor carriage, which was first seen on the street the other day.

Whitney Lyon, Hotel Beresford, New York, who owns an electric carriage, wishes to organize an automobile club in New York City. Those who are of the same mind should communicate with him.

The Atlantic Electric Vehicle Co. has been incorporated in New Jersey, with \$100,000 capital. The incorporators are James H. Nixon and Charles P. Rooney, of Philadelphia, and F. D. Weaver, of Camden, N. J.

The Electric Vehicle Co. are building a truck at their shop, 215 East Forty-second street, which is to be used to haul merchandise from the docks to the big dry goods stores. The weight will be about 4,500 pounds, and the load one ton.

Frank Mossberg, designer of the electric carriage which the United States Automobile Co. are building at the Diamond Machine Co.'s shop, Providence, R. I., expects to have the vehicle on the road by July next. It will weigh about 1,200 pounds, and run about thirty miles on one charge.

The Pennsylvania Electric Vehicle Co., of Philadelphia, addressed a communication to the Fairmount board, asking if there are any rules governing automobile vehicles in the park, as it is the intention of the company to organize a service in the city. The matter has been referred to the committee on superintendence and police for inquiry and report.

The General Carriage Co., of the State, has been incorporated at Albany, N. Y., to operate carriages in New York and Buffalo. The incorporators are Henry B. Livingston, Reginald W. Rives, Prescott Lawrence, J. F. Kernochan and Thomas St. John Gaffney. It is said that one of the company's projects is to introduce motor vehicles in Buffalo for the coming Pan-American Exposition.

The Leads Motor Vehicle Co. was incorporated in New Jersey last week with \$5,000,000 capital.

The Lamb Mfg. Co., Chicopee Falls, Mass., are importing several different styles of foreign vehicles.

The Capital and Sacramento Transfer Co., 906 K street, Sacramento, Cal., contemplate using motor vans.

The Electric Storage Battery Co., of Philadelphia, is reported about to establish a branch plant in New York.

C. W. Miller, who does most of the baggage transfer and hack business of Buffalo, N. Y., is investigating the motor vehicle.

The Canada General Electric Co., Peterboro, Ont., will build electric cabs for the Canadian branch of the Woods Motor Vehicle Co.

E. A. Cooper, Britton, South Dakota, has ordered a gasoline carriage and expects to act as agent for the manufacturer in his State.

The Federal Car Truck and Motor Co. has been incorporated in New Jersey with \$300,000 capital, by John H. Carnes, Joseph Wells and James E. Fielder.

Stanley Bros., Newton, Mass., have assembled the first of their new model steam carriages, which is pronounced superior in appearance and construction to the old machine.

The Railway Cycle Manufacturing Co., Hagerstown, Ind., intend to have the Teeter rotary engines, which they build, thoroughly tested at the laboratory of Purdue University.

The *Electrical Review*, of New York, believes the electrical vehicle lacks a name, and offers a prize to the one who will invent the best name for it. Second and third prizes are also offered.

David Allen Reed, treasurer of the Duryea Motor Wagon Co., has just returned from abroad. He expects soon to make the announcement of the closing of the sale of the Duryea foreign patents.

A recent Maine corporation is the American Motor Carriage & Truck Co., with \$300,000 capital. The officers are: President, Albert H. Rolfe, Newton Centre, Mass; treasurer, W. M. L. McAdams, Newton Highlands, Mass.

The Commissioners of Fairmount Park, Philadelphia, Pa., are dubious about allowing motor-vehicles in the park. They have wisely decided, however, that before making regulations to govern these vehicles they will witness practical tests of the various types.

The recent organization under New Jersey laws, of the Columbia Automobile Co. indicates the separation of the motor carriage department of the Pope Manufacturing Co. from the bicycle department, which is said to have been merged in the bicycle trust. The motor carriage works will now be enlarged.

W. Lee Crouch, New Brighton, Pa., whose steam carriage was described in our issue of April 5th, is organizing a company in Baltimore, Md., to manufacture it. The president will be D. A. Clark, 2021 Maryland avenue, that city. L. R. Davidson, Beaver, Pa., will also be interested. It is said the name of the corporation will be the Crouch Automobile Mfg. & Transportation Co.

PARIS JOTTINGS.

The latest accession to the chauffeurs is the Czar of Russia, who has ordered a petroleum tricycle in Paris, and is having a trailer built in St. Petersburg after his own designs.

The "selling races" which were undertaken in France proved failures. The prices charged for second-hand vehicles were evidently too high to attract purchasers.

The large number of applications for space at the motor vehicle exhibition to be held this summer at the Garden of the Tuileries, has led the Exhibition Committee of the Automobile Club to petition the government for a larger portion of the garden than was used last year.

The recent race for alcohol motor carriages from Paris to Chantilly and back proved a dismal failure. Quite a number of petroleum carriages were brought up to the test, alcohol being substituted for petroleum as fuel. A stormy day dampened the ardor of the contestants, and as for the engineering world, it never regarded the alcohol proposition with much favor.

Exhibits at the New York Electrical Exhibition.

The Riker Electric Motor Co., Brooklyn, N. Y., will exhibit during the course of the show a theatre bus, runabout, phaeton, trap, heavy truck and a brougham.

The exhibit of the Indiana Bicycle Co. will consist of four small runabouts—such as illustrated in our current issue—a Stanhope, a buggy and a delivery wagon. The Stanhope was shown in our February number, and the delivery wagon in the issue of April 19.

The very stylish runabout here shown is the product of the Indiana Bicycle Co., Indianapolis, Ind.

Its weight is 1,200 pounds, and its radius of action thirty to thirty-five miles. The motor is of $1\frac{1}{2}$ H.P., and the maximum speed obtainable is fourteen miles an hour.



WAVERLY ELECTRIC RUNABOUT.

The Dreadnought Tire.

The Dreadnought Tire, the subject of the accompanying illustration, is intended for use upon motor vehicles, although up to the present it has only been applied to bicycles, in which field it is said to have proved entirely satisfactory, the features being that it is absolutely puncture proof, and at the same time is lively and resilient to the highest degree. The peculiar formation of the tread surface affords several advantages not found in round tread tires. The central rib enables the tire to travel over a hard road with a minimum of surface friction, and without suction or drag, and the flat surface enables it when traversing a loose or sandy road to pack and make its path without sinking in and dragging through.



The wood members in the tread, which consist of flat pieces of wood having concaved sides with pivots or dowels between them, afford a positive protection against punctures, and at the same time comprise a perfectly yielding band which does not in the slightest degree detract from the free yield of the tire.

The Dreadnought is also said to possess another important advantage in its ability to get out of ruts and over car tracks readily, because its flat edge, being elevated by the rib, serves to grip the wall of the rut or rail, and to act as a lever in carrying the tire thereover; whereas a round tire, similarly situated, would merely slip along the rut or rail from the inability of the rounded surface to get a purchase.

The manufacturers, the Dreadnought Tire Co., 253 Broadway, New York, are now preparing these tires in the various sizes for vehicles.

The German War Department has decided to adopt motor wagons in the service, and bids have been invited for the supply of the transport and commissariat departments with them.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

Motor Vehicle Wheels.

BY ROBERT I. CLEGG.

It is well, at the outset, to point out that here, as in other details, a wide difference exists between the conditions under which the horse drawn vehicle and the motor vehicle operate.

First of all, the size of the wheels, when preceded by the horse and attached to a frame, in the main of wood, will be large, to bring the line along which the pulling force is exerted as nearly as possible horizontal, and height is also desirable as a matter of cleanliness and comfort when following the dust and dirt producer so closely. When the frame was almost wholly of wood much heavy bracing was needed to get the carriage seats of the desired height to allow the driver a clear view over the horse. Now, with the advent of the tubular steel frame a frame of graceful lines can spring from the axles to the desired height, and smaller wheels can be used.

For a motor vehicle both the driving and steering wheels may be small for two reasons at least. On the steering wheels the contact of the tires with the ground will take place over a considerable surface, the total pressure being, of course, distributed over this flattened area. Hence a large wheel with a yielding tire, either cushion or pneumatic, will have a greater area of contact than a smaller wheel with like pressure and tire of the same degree of resilience. It is desirable that the steering wheels be easily moved even while the machine is at rest, and the smaller the area of wheel contact with the ground the less the friction to be overcome. When the carriage is in motion less effort is required to turn the steering wheels, because of the motion about the horizontal axis already existing. The driving wheels are small, as a rule, for the reason that great strength can be secured without the greatly increased weight of large driving wheels. So far we have proceeded upon the assumption that the ground is firm and unyielding, a condition which, even in cities, is not an invariable rule of the road. A small wheel under these circumstances will sink deeper into the loosely compacted surface than a large wheel, assuming that both have other conditions in common.

Suppose we take a wheel and wet the pneumatic tire with a liquid—water, for instance. Let the wheel now rest upon the ground, and apply the pressure of actual usage; then lift and remove the wheel, leaving a print of the wheel contact

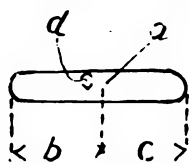


FIG. 1.

as in Fig. 1. In steering the machine the wheel is swung vertically around the center, a. Obviously if the wheel is increased in diameter, the lengths b and c increase and add to the difficulty of twisting the wheel. If the length, d, could be increased leaving b and c constant, the resistance to sinking in the soft earth would increase with the area, and the levers b and c would be unchanged. This is accomplished by using larger tires in preference to increasing the diameter of the wheels, as shown in Fig. 2.

Another point is that when passing over an obstacle the center of a large wheel sweeps through the arc of a circle of greater radius than would the axis of a smaller wheel; thus,

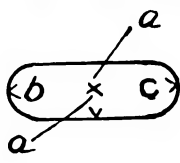


FIG. 2.

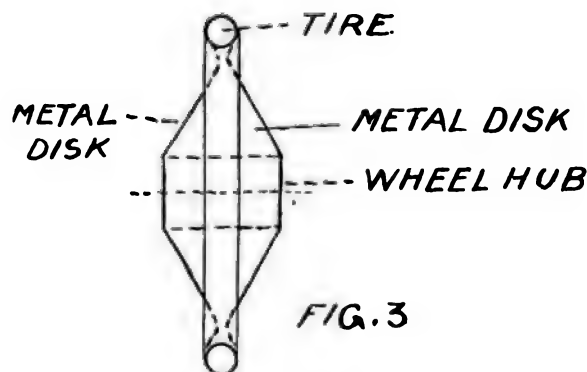


FIG. 3

a large wheel passes over a stone with less shock than a small one. With the general use of the pneumatic tire, however, less importance is to be attached to this, for the inequalities of the road are compensated by the yielding tire, and the elastic tread renders the reaction, when rolling over obstacles, fairly equal, and, consequently, there is little or no loss of energy.

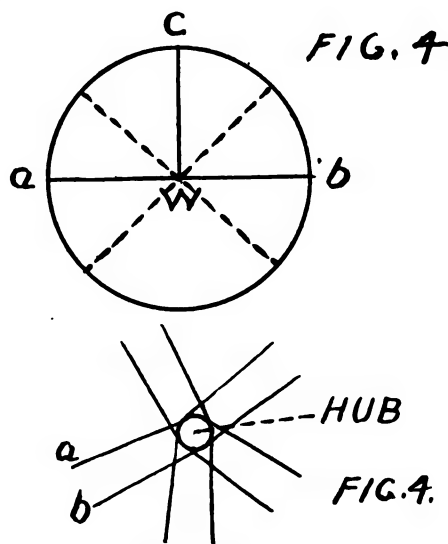


FIG. 4.

The writer is strongly impressed with the advantages of the metal wheel, so far as the spokes and hub, at least, are concerned; but here it may be said that among the mechanics who have taken up the study of the practical motor vehicle too little credit is given to the coach builders, and possibly, also, too little advantage is taken of the experience garnered in the practice of their craft. I have had some acquaintance with four vehicles of what may be termed the transformed class; viz., a motor applied where formerly a horse supplied the motive power. In each case a sprocket or internal gear was bolted to each of the rear wheels by means of the regular clips and distance pieces between the sprocket run and the spokes. It is not to be wondered at that good mechanics, who were well acquainted with the shrinkage of wood and the influence of weather and temperature, pronounced the wood wheel an absolutely untrustworthy foundation for driving gears.

"When you get through fastening that wheel it will drop off," one of these critics observed to a workman who was truing up a combination of bronze gear and wood wheel.

But prophecy is dangerous unless you know, and that same arrangement has bumped over city cobbles for many miles,

and still clings together. Several reasons may be advanced for the staunch behavior of wooden wheels under severe service. Wood, for example, is elastic, and the action of a spring placed under a nut being well known as an efficient lock against shaking or unscrewing the same, opportunity is not afforded the gear to shake loose if properly tightened in the first place, so long as the wood preserves its natural resilience. Then again, the paint and varnish not only tend to preserve the wood from the weather, but also act to retain both gear and other parts in their relative positions.

I am convinced that rivets will be more commonly used by motor vehicle builders, but at present both screws and bolts may have greater efficiency if well treated with paint, etc., as already mentioned.

If a wheel be considered as a disc, thick enough to resist any tendency to buckle, then the load at the axis is transmitted to the point of contact of rim and ground by compression of the material of which the disc is made; this is precisely the case where the spokes are numerous enough to give a fairly regular motion without a separate rim.

When a rim is added to a wheel composed of numerous spokes, the latter are no longer required to maintain a smooth rolling motion on the ends of the spokes, and so their office is now limited to withstanding the compression due to the transmission of the weight from axle to rim. As the spokes must, in a wheel of this kind, be stout and stiff to avoid bending under compression, considerable material is put into the spokes, and this again calls for a thickened hub and rim at the points of attachment. In the early days of the bicycle a compression wheel was brought out in which the spoke Jonah was thrown overboard entirely. As nearly as I remember, the wheel was built up of two coned metal discs somewhat as in Fig. 3.

The wheel was very light, the discs being of thin sheet steel; but the appearance was very heavy, and this militated against its adoption.

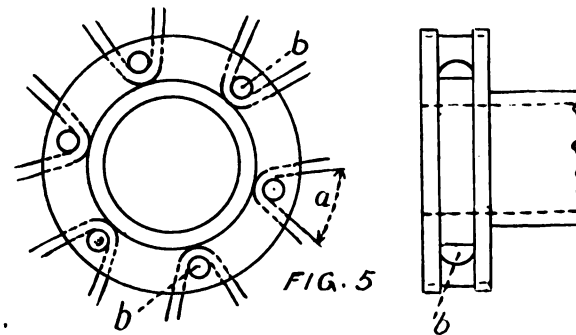
The suggestion has been made of a single disc of sheet steel stiffened by wooden strips on either side of the wheel, but the idea has not commended itself to cycle or motor vehicle builders.

If we take a stiff rim and suspend a weight from its upper edge while the rim rests upon the ground the weight tends to drag the top and bottom sides together, while the right and left will be correspondingly spread apart. Fig. 4.

If the sides of *a* and *b* be restrained by cords attached to *W*, then between *a* *c*, *c* *b* and *a* *b* other cords must be introduced along the dotted lines to preserve the truth of the circular rim, and as the distance between the spokes or cords lessens, so is the strength of the rim against deformation increased. This is the common suspension wheel, the weight *W* representing the loaded axle. If we still suppose the cords to be tied to *W*, and that we rotate *W* and at the same time hold the rim stationary, we shall find that the axle can be moved independently of the rim some little distance. If the cords were attached as in Fig. 5, however, this relative movement is lessened.

If steel wire is substituted for the cords, and they are firmly attached to each other where the pairs cross, the relative motion of the hub and rim approaches a minimum. This is the regular suspension wheel with tangent spokes.

Instead of attaching the spokes on opposite sides, the plan has been tried of making, say *a* *b* in Fig. 4, of one length of wire; the hub has had a number of grooves turned in it to gain additional purchase, and the friction of the wire on the sides of the grooves has been sufficient to hold the hub. This certainly made a simple connection without the need of enlarging spokes or threading nuts and swivels or other devices in vogue to link the spokes to the hub. Whether the hub looked unsightly with the added wire, or whether there



may have been some other fundamental defect in the scheme I cannot now call to mind, but the process is not now a common one. A somewhat similar plan has been suggested which avoids the necessity of going around the hub, and seems both neat and feasible.

As originally given the angle at *a* was 90° . In Fig. 5 a lesser angle has been selected, though sufficient data is not yet obtainable as to the positive advantages of either one or the other plan. The pins *b* are grooved to the size of wire and are then locked in place when the spokes are tightened. If the wires at *a* are at an angle of 90° , then where they pass each other the spokes may be wired and the whole structure rendered so much stiffer.

Several wheels have been introduced in the bicycle industry that may later come to the surface in the manufacture of motor vehicles. I refer to those in which a spring connection is made between the hub and the rim. The hub may be double, one inside the other, connected with springs, a rubber cushion, or even a pneumatic chamber, to give the requisite elasticity; similarly the rim may be doubled and like devices applied.

Again, the spokes may be attached by way of spiral springs, either at the hub or rim, and further, the spokes, instead of being straight, may be variously curved. Each of these, and doubtless many others have been tried, and probably abandoned for good reasons.

It can be suggested that with a solid tire and spring spokes, or like contrivances, the entire rim is lifted when meeting a small obstruction, and as the rim possesses inertia the effect is a tax upon the energy applied. A similar obstruction would not have nearly so marked an effect on a wheel with pneumatic tires, since the tire would give locally at the point where the pressure was made, with little or no effect upon the wheel as a whole. Both plans might be adopted in the one wheel, but I fail to see any advantage to compensate for the unavoidable complication, and in this as in other motor vehicle matters simplicity is supreme.

As the straight wire spoke is relied upon for the lateral, or sideways pressure, it will be noted that a substitute must be contrived if we introduce springs between the hub and rim. In several of the plans mentioned slides are used in conjunction with the springs to keep the plane in which the rim revolves at right angles to the axle.

In the present state of the art, indications are not lacking that heavy teaming may, at no distant day, be handled largely without the horse, and as every means to that end is worthy of mention, though not always sure of adoption, wheels used for agricultural machinery are notable. Light, strong and cheap, built for use where repairs are not likely to be had, they are rapidly turned out by machinery that may later equip the heavier motor vehicles with wheels.

For the lightest motor cycles the ordinary bicycle wheel is ample in strength and but little improvement is to be expected, excepting possibly, some manufacturing detail causing but little change in the appearance of the wheel.

OUR FOREIGN EXCHANGES.

A Petroleum Turbine.

This ingenious motor is the invention of two Norwegian engineers, Paul Irgens and Gerdt M. Brunns. Fig. 1 represents a vertical section through the shaft of the motor. Fig. 2 gives a view of the wheel or turbine. Fig. 3 shows the vaporizer. On the base of the motor, 1, is bolted a casing 2, terminating at the top in an exhaust passage. In the center of the spider, 4, cast with the base is a bearing, 6, which carries the motor shaft, 20, and supports the vaporizer 7, the latter having five passages, 8, provided with burners, 9, at the base, and through which the explosive gases are forced upon the blades, 22, of the turbine, 21. The oil enters through the pipe, 10, into an annular conduit, 11, which opens out at the top and has a depending branch-like formation, 12, between the passages, 8. These branches are joined at their ends by the passage, 13, with which the burners 9 communicate, so that the explosive mixture in the branches is vaporized by the said burners, 9. These burners are placed in niches, 14, into which the passages, 8, lead, the passages being inclined as indicated in Fig. 3 so that the gases may strike the blades of the turbine at the proper angle. Suspended from the top of the shaft, 20, is a peripheral sleeve or casing having wings, 24, at its base, and an annular space, 15, between it and the vaporizer, 7, which at its lower portion has a pan, 30. The flexible needles, 16, which open the burners, are all joined at the lever, 17. To start the motor a little alcohol is turned into the receptacle, 30, the plug, 31, having first been removed. This alcohol being ignited, the heat vaporizes the petroleum, which spreads through the passages of the va-

pORIZER 7, and reaches the burners and ignites. The current of air and gas then exerts a pressure on the blades of the turbine and puts it in motion.

The auxiliary wheel, 23, also turns and forces fresh air to the burners, making complete combustion, keeping the temperature of the outer casing of the motor relatively low, and reducing the loss of heat by radiation.

To cool the moving parts a space is left between the wheel, 23, and the casing, 2.

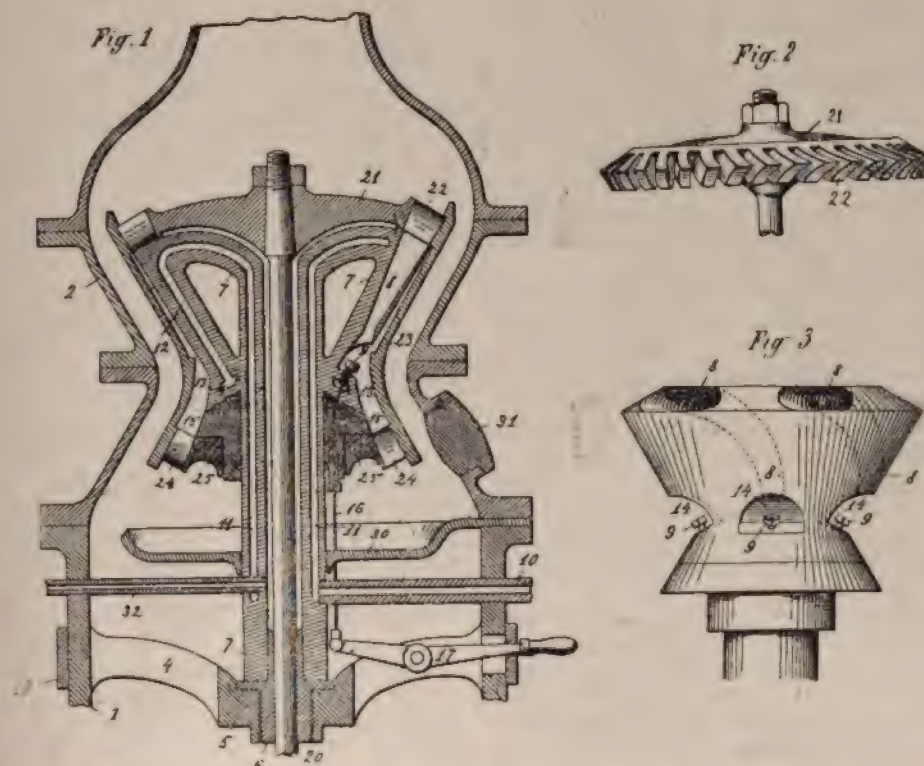
The fluid should be forced into this motor under a strong pressure and the flow regulated by the speed of the motor.

The Butikofer Motor Bicycle.

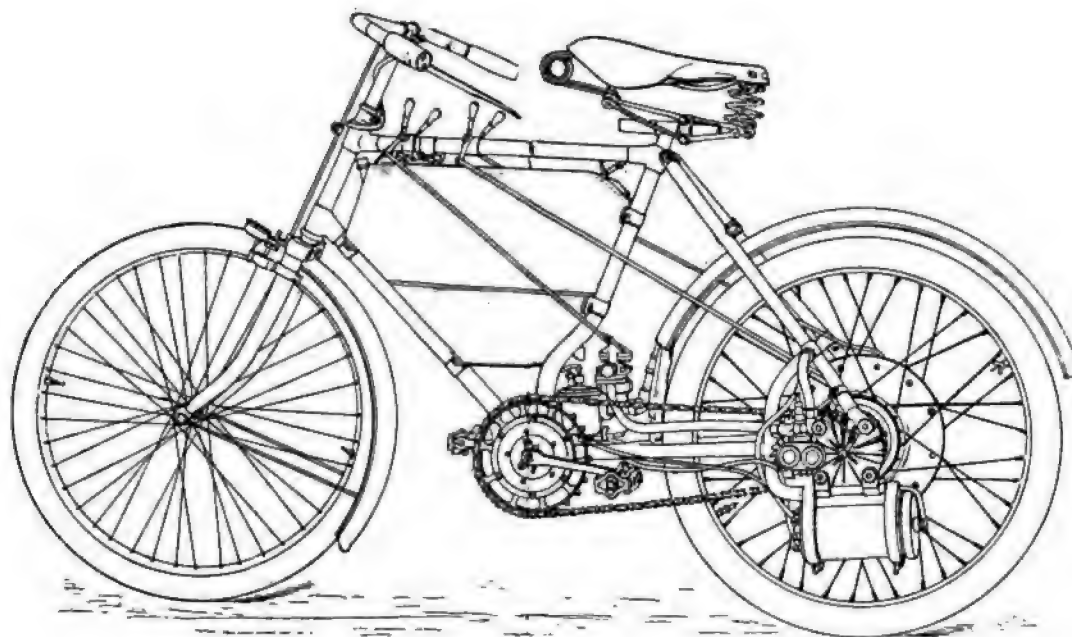
Says *La Locomotion Automobile*, the more the motor idea grows the more the need of a motor bicycle is felt. Many persons who would like to possess motor vehicles cannot afford even a tricycle at present, or have no means of storing a large vehicle within a convenient distance. The motor bicycle, it thinks, offers the right thing to this class of purchasers.

The simplest idea of this kind yet devised places the motor along the tubular frame and transmits the power to the wheels by chain or belt. M. Butikofer has conceived the plan of utilizing his motor as the axis of the drive wheel, and so places it horizontally across the wheel. This arrangement lightens the load on the frame, which then carries only the carbureter and the oil and petroleum tanks, and is said to prevent disagreeable vibration.

The single cylinder Otto cycle motor lies across the rear wheel, held firmly in place by the rear forks. In the cylinder, a, is the piston, b, which, by means of the crank shaft, turns



PETROLEUM TURBINE OF IRGENS & BRUNNS.



THE BUTIKOFER MOTOR BICYCLE.

the fly wheels, f. Upon the axis, e, of these fly wheels is fastened a gear, h, which meshes with the pinion, g, solid with the hub, q. At the left of this box, q, is a pinion, s, over which passes the chain, and attached to it also are four cams, m, which raise the exhaust port, k. The automatic inlet valve is at i.

Ignition may be by hot tube or the electric spark.

Improvements in the Bollee.

One or two important detail improvements have recently been introduced by La Societe des Voiturettes Automobiles, of 163 Avenue Victor Hugo, Paris, in the Bollee voiturette. As this vehicle is already very familiar to chauffeurs on both sides of the Channel, it is not necessary to give a lengthy description of it, and we shall consequently confine ourselves to the improvements above alluded to. One of the drawbacks to the voiturette has hitherto been that the frame, carrying both the motor and transmission gear, as also the riders, was mounted directly on the wheel axles, and thus all vibration, jolting, etc., over and above that taken up by the pneumatic tires, was transmitted to the riders, while the rear wheel was subject to slide-slip or skidding. To overcome these disadvantages the Bollee Co. have now introduced a new type in which a plate spring is introduced between the frame and the front axle. In the old type, Fig. 3, the latter was straight, but as will be seen from Figs. 1 and 2, a cranked tubular axle is now employed, a large plate spring being introduced between it and the end of the frame. To strengthen the connection between the frame and the axle two short levers are mounted on the latter and connected at their lower ends to the tension stays of the frame. The two levers are free to turn on the axle and are pivotally connected to the stays so that they may adjust themselves to the relative vertical movement due to jolting, etc., of the two parts—the front and the rear—of the voiturette. In addition to the increased comfort afforded to the riders the new suspension arrangement is claimed to con-

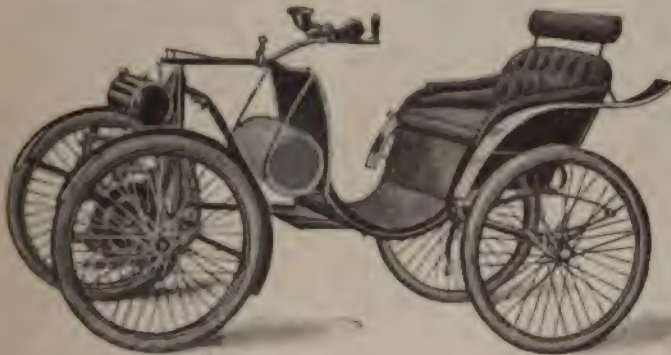
siderably minimize the tendency to skidding of the rear wheel the reason advanced for this being, according to *La France Automobile*, as follows: "The power which causes the rear wheel to slip sideways should, in theory, be absorbed by the forward progression of the vehicle, or by the application of the brake. In practice, however, it has been found that neither of these absorb all the power in question, but it expends itself in causing the rear wheel to drag laterally. In the new suspended frame the rear wheel, when turning, inclines slightly with the frame, the power which in the old system caused the wheel to slip being absorbed in compressing the plate spring." The new spring-suspension arrangement alters the appearance of the voiturette but little, the spring being hidden underneath the front seat; it can, we understand, be applied to existing vehicles at the cost of a few pounds.

The second improvement is in connection with the tube ignition employed on the Bollee voiturette. In the ordinary platinum tube there is a small collar fixed tight up against the tube-carrier, threaded into the opening in the explosion chamber by means of a capped nut, the bottom of which is furnished with rings or washers of asbestos. Owing to the progressive carbonization, these rings require to be frequently tightened up, and also renewed from time to time, as any leakage at the joint would reduce the compression, and interfere with the working of the burner to such an extent as to occasionally cause misfires, and so diminish the power of the motor. Furthermore, owing to the high temperature, it is not often possible to promptly put the burner into proper working order again. To overcome these drawbacks the Bollee Co. have lately introduced a new joint, in which the use of asbestos washers and their consequent disadvantages are obviated. The joint comprises a tube-carrier A (Fig. 4), screwed into the opening in the explosion chamber in the usual way. The carrier terminates at its outer end in a small cone a. The end of the platinum tube B is opened out to a shape to fit tight over the cone a, the two parts a and b being held close together by the washer C. When the latter is fixed in its proper place

the capped nut D is screwed down to the tube-carrier A, the result being that the three parts of the ignition tube are hermetically maintained together without the employment of any packing whatever.—*Motor Car Journal*.

The Victoria Combination.

La Locomotion Automobile, in a recent issue, gives a notice of a combination victoria, introduced by the Société Parisienne, a species of vehicle midway between the tricycle and the tricycle with trailer.



The vehicle has two distinct parts, the forward axle motor and steering part, which carries all the machinery, and the passenger vehicle proper, which is attached to the forward part only by a jointed rod.

The motor is a $1\frac{3}{4}$ H.P. De Dion, fastened upon the axle as in the well-known tricycle. The Longuemare carbureter is employed.

The gasoline tank above the wheels contains enough oil for a run of over 100 miles. Grades of 6 or 7 per cent. can be surmounted, and by adding a low gear steeper hills can be surmounted.

The "Motor-Car Journal's" Commercial Efficiency Trials of Motor-Vehicles.

In connection with the Exhibition of Motor Vehicles to be held at the Agricultural Hall, London, next July, the proprietors of the *Motor Car Journal* have decided to inaugurate a series of trials of motor-vehicles, essentially from a commercial point of view. Racing forms no part of the programme, and it is a feature of these competitions that no vehicle shall travel at an average speed which is greater than the maximum permitted by law. Gold and silver medals will be awarded to all contestants who carry out a series of specified journeys within the limit of a certain given maximum and minimum time; thus the competitors will gain no advantage by indulging in racing.

There are fourteen different classifications of vehicles, each one being allotted to a task well within its capacity, and varying according to the type of vehicle, and to the regulations of the Board of Trade as to the speed to be traveled. The competing vehicles in each class will each have to travel over the same roads on the same days, and, excepting a few minutes' interval in their starting, exactly at the same hours.

The trials of each type of vehicle extend over three days, and the allotted journeys have to be completed within the limits of the set times on each of the three days, and this without effecting any repairs or making other adjustments than those within the capacity of an ordinary motor-car driver, and those

possible to be effected by means of the kit of tools generally carried on such vehicles. A compulsory stop is arranged as nearly as possible in the middle of each day's task, and this is allowed for in the maximum and minimum times allotted for completing the journey. No allowance will be made, however, for any other stops, and it is needless to say that an observer acting upon the behalf of this journal will accompany each car. Shortly, the competition may be said to test the ability of the vehicle to run a given distance according to class or type out and home each day for three consecutive days. The routes selected will be of a fair give-and-take character, and it is not proposed that any extraordinary task shall be set, it being the aim that the designed task shall be as nearly as possible in accordance with the duties required of a motor-vehicle in ordinary private use.

The classes comprise delivery vans carrying 15 cwt. of goods, propelled (a) by electricity and (b) by petroleum motor; goods vehicles carrying 30 cwt., and goods vehicles carrying three tons. In addition all these vehicles have to carry at least one person besides those necessary for driving the vehicle. The pleasure carriages are comprised in four classes, two of them being devoted to two-seated vehicles, one propelled by electricity and the other by steam or spirit motors, and two classes for four-seated vehicles, one propelled by electricity and the other by steam or spirit motors. Four classes are devoted to motor vehicles carrying eight persons and sixteen persons, one of each type being driven by electricity and the other by steam or petroleum spirit motors. The fourteenth class is devoted entirely to carrier motor tricycles or voituresses, having motors developing no more than 3 H.P., and carrying not less than 200 lbs. weight of goods in addition to the driver.

Another competition also forms a part of the programme. This is for any type of vehicle carrying four persons or a similar weight in goods. The feature of this competition is the longest run possible to be effected with one supply of fuel, power, lubricant, etc., as is arranged for vehicles of the type entered. It is not intended that this class should embrace vehicles especially built with abnormally large power supplies, but is intended to embrace commercial types of vehicles only. Arrangements are also in progress for furnishing the means for testing motor tricycles. With these vehicles, however, speed is the great consideration, and these trials, if ultimately carried out, will be run on a racing track before the exhibition takes place. The whole of the other trials will take place between July 3d to the 16th, during the continuance of the exhibition at the Agricultural Hall. The start and finish will be from the Agricultural Hall itself, and therefore the heavy traffic of Islington will have to be encountered, both on the outward and homeward journeys.

Entry forms for the competition are now ready, and these, together with the fuller particulars, may be obtained post free on application to the offices of the *Motor Car Journal*.

AKRON, O., April 20, 1899.

Editor HORSELESS AGE:

Will you be kind enough to say in the columns of your paper if there is a gasoline explosion motor on the market, of say, 4 or 5 H. P., which can be started by moving a lever, in stead of the old way of turning the balance wheel with a crank; and whether the motor would be suitable for small launch? If there are any such, please name them.

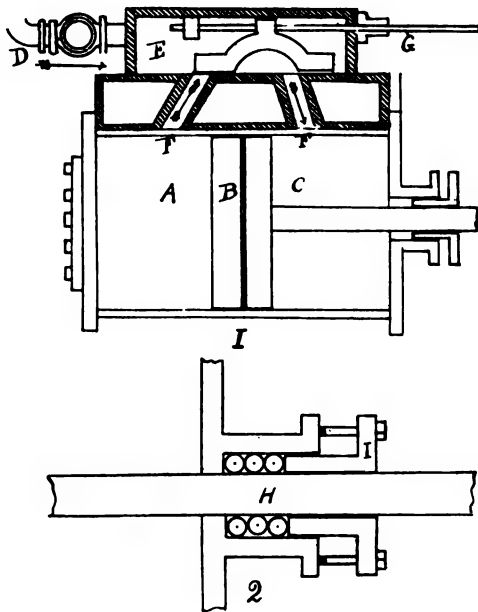
Thanking you very kindly in advance, I am,

Yours respectfully,

F. H. ADAMS.

Power Transmission In Motor Carriages.

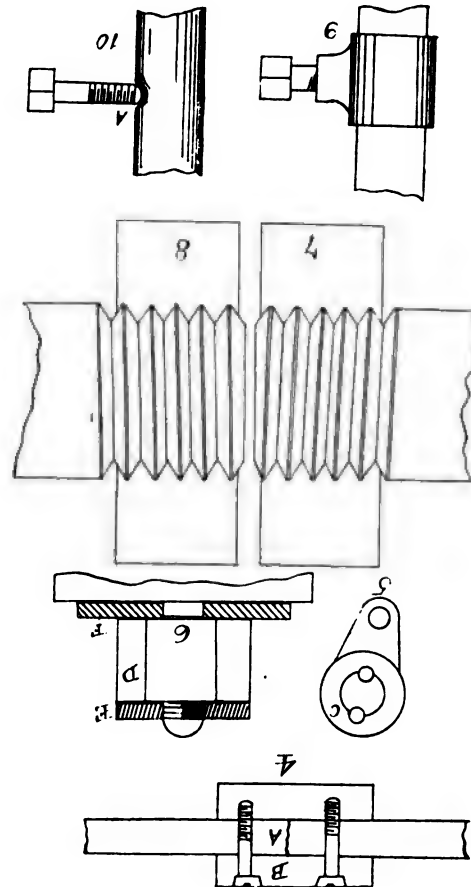
Power transmission in motor vehicles is affected by leaky piston valves of cylinders and valve chest, by imperfect adjustment of slide valves, by too tight packing, clogged stuffing boxes, parts gummed with oil or dry from lack of oil, loose nuts and set screws, and similar defects in the motor or connections. Few machines show the care and ability of the engineer or machinist in the matter of lining up and putting into correct running order modern power apparatus than the horseless vehicle. Horseless vehicle engineering is new to many men who have devoted a lifetime to the repair, construction and adjustment of the ordinary carriage and wagon. The accompanying cuts may be of some assistance in explaining the care and maintenance of these machines. In Fig. 1



is a sectional drawing of the usual form of cylinder used when the motor is driven by steam or compressed air. The discharge of steam or compressed air is received into the pipe, d, and admitted into the valve chest, e. The ports are marked f, f, and when the slide valve rod, g, is caused to move the valve, by means of an eccentric on the shaft of the carriage or wagon, steam or air is let into the cylinder at a, where the pressure forces the piston b forward. The receding movement is accomplished when the opposite port is opened by the reversed motion of the valve, which lets the steam into the side of the cylinder indicated by c, thus forcing the piston back. This movement, although generally simple, and very like the principle of the steam engine cylinder or the steam pump cylinder, in which the connection with the pump is made direct with the water cylinder, thus doing away with the fly-wheel and cranks, is often puzzling to motor carriage engineers.

The trouble is that they attempt to alter parts and overcome defects without first making a study of the engine and its attachments. In one case the writer found that the engine was at a complete standstill, owing to the man in charge trying to stop a leak at the stuffing box by screwing up on the

flange bolts. A sectional view of the box is shown in Fig. 2, in which the piston rod is marked b, and the flange piece i. Round packing is usually used, and when correctly adjusted there will be no escape of the contents of the cylinder, nor



will that hissing noise be heard which is due to leakage at this point. If this part leaks, instead of tightening up on the bolts, thus binding the packing on the piston head and causing much friction and loss of power, overhaul the box by removing the bolts and packing, and if necessary, put in new packing.

WHEN A PISTON ROD BREAKS.

I have seen cylinders of carriage motors so inaccurately set as to cause breakage of parts. Recently one of the piston rods of a gasolene motor snapped short off midway between the stuffing box of the cylinder and the crank of the shaft, on account of the wedging of two beveled gears attached to the propelling shaft. As no rod could be obtained at once, and as the owner of the carriage could not wait for a new piston to be made, the rod was joined in the manner shown in Fig. 4, and has since done effective service without showing indications of giving out. A shell or sleeve, b, was turned out of tool steel to fit over the broken place, a, and this shell was set-screwed in the manner shown. The set screws pass through one side of the shell, through the rod, and part way into the opposite side of the shell.

RECTIFYING A RATTLY CRANK.

Carriage motors frequently fail to give the best service, owing to looseness of connections. In one instance which re-

cently came to notice the crank was secured to the axle of the carriage by means of a single round key. The key was provided with means to prevent loosening and working out of its seat, but it proved to be lacking in strength when put to practical road service. The round key worked loose in its seat without changing its position, and so deceived the owner. When investigated by an engineer familiar with the action of round keys, it was readily seen that the remedy was to increase the binding of the crank to the shaft by putting in another key at c, Fig. 5. This key, being put in opposite the original key, served as a binder, which made the crank set firmly to the shaft, and it rattled no longer.

NUTS WORKING LOOSE.

One of the most troublesome features to the motor carriage engineer is the working loose of nuts and set screws. The lock nut is a good remedy, as shown in Fig. 6, in which the locking nut is marked e, and the full or regular nut d. The washer is f. Some workmen put the lock nut on as shown in cut, which is not correct, as this nut contains but two or three threads, and the right place for it is at the bottom, next the washer, where there is practically no strain on the threads, but where the thin nut prevents the larger nut from turning. The constant jarring to which nuts and other threaded devices on rolling stock are subjected tends to work them loose unless means are provided for preventing. Lock nuts, double nuts and various patented devices are utilized by railroad men, and yet nuts loosen at times. Take a threaded nut and bolt of the right threaded pattern and hold it horizontal, as in Fig. 7, and rap the bolt with a hammer, and the jar will cause the nut to turn a little to the right at each rap. Similar action occurs on a left handed bolt, as in Fig. 8, except that the nut moves to the left and will finally drop off, if not prevented. This tendency is of course overcome by making the nut bind against something, *i. e.*, by using lock nuts or special attachments. Of itself, a nut will seldom work tight, for the reasons shown in Figs. 7 and 8, as the tendency is for the beveled threads of the right cut bolt to move the nut off to the right and the left cut off to the left, by gradually turning the nut at each jar of the machine, unless, as before stated, the nut is secured by frictional contact or special attachments.

THE SHAFTS.

The shafts of gear driving wheels should always be of standard size. Sometimes they get worn off size by a loose gear. In that case the shaft ought to have some stock "upset" on the end of it, and then turned up to standard size. If the gear does not then fit tight, and turn perfectly true in the lathe, the only thing that can be done is to bore it out and bush it, and then bore a true hole, with the rim as a basis to calculate from. Once the gear is true the other parts can be gotten right. The side shaft should have a collar on it, on the gear end of the shaft and on the inside of the box. The pinion gear is always pushing the big gear outward and wearing the inside end of the shaft box, and with this collar you can set up tight and know just what place you can set your big gear and depend upon its running there. When you have the big gear off, don't fail to get a collar slipped on. When you go to fit the pinion gear on the short shaft, there is another chance for a careful job. At best they are not strong. There is not room for a sufficient bearing, according to present ideas, so it is necessary to have a snug, true fit to lend as much stability to the work as is possible to get.

CUT SHAFT.

Another thing which bothers motor vehicle engineers is shown in Figs. 9 and 10. A collar is set screwed to a shaft or rod, and the force applied in time causes the point of the set screw to cut a groove in the shaft or rod, as at Fig. 10. This leaves room for the screw to wobble about in the scored place, and considerable bother is caused in making adjustments, for the reason that if the adjustment places the tip of the screw near the grooved place, the jarring of the machine may eventually cause the point to drop into the cavity, and, of course, loosen the adjustment at once, and perhaps cause an accident. The way to overcome these defects is to replace all scored shafts with new ones, and then use set screws in which the tips are not calculated to score the metal.

TRUING THE GEAR.

It may be necessary to true the gear. With a gear in a boring machine a couple of studs had better be bolted to the face plate in position to turn the gear as it hangs free from the center. When all is ready, start the gear and get it running up to the speed it is to travel when it is placed upon its shaft. Sometimes trouble will be discovered before the gear has made fifty revolutions a minute; one part of the gear will begin to run toward the table or face-plate, while the opposite part seeks to get up above its normal position, and if run fast enough would seek to place itself directly in line with the spindle upon which it runs. After the irregularity is located, the gear can be trued by turning off the unevenness, or by milling out the bore. The cheapest cutter for milling out irregular gears is the porcupine mill made by taking a cast iron hub and filling it with hardened steel pins like the quills on a porcupine. The hub should be turned similar to a solid mill, and spaced off into $\frac{1}{4}$ inch spaces in the lathe by cutting circles with a V-pointed tool. On each circle drill for $\frac{3}{8}$ inch pins, so as to have them break joints as much as possible, and grind the pins similar to a wide-nosed finishing tool, and the mill is done. With a little care in grinding the work will come smooth and even, and the ease with which the cutter will run is surprising.

STEEL SPRINGS.

The repairman is often required to turn off spiral steel springs and temper them. They are tempered in oil and charcoal, being first hardened and then drawn to a strong temper, when the oil is wiped off, and they are put in a "rolling-barrel" machine and rolled in emery to make them smooth, whence they are put in another "roller-barrel," filled with sawdust, etc., which gives them polish. An inspection follows, when any little finishing touches are added. The success of spiral springs is due, in a large measure, to the care used in tempering and inspecting. A very careful inspection and the prompt rejection of all, even slightly, imperfect springs is in the end a great economy for both maker and user.

BORING PARTS.

Much time can be saved in boring out irregular shaped parts of machines, when they are to be held in a face-plate, by first blocking one up on four wedges and holding it in place with a yoke, and then pouring babbit metal around it to form a bed for the casting. Small castings, which draw easily when in the mould, will set firm in a bed of babbit metal, provided the bed lies in the same way that the division line in the flask comes, and takes but little strain on the yoke to hold it in place.

HORSELESS VEHICLE ENGINEER.

LESSONS of the ROAD

Users of motor vehicles are invited to contribute to this department for the good of the industry.

The Intelligent Horse!

HARTFORD, April 18, 1899.

Editor HORSELESS AGE:

The average horse must present a different view to a passing motor carriage from that he presents to the rest of the world. Unless this is so, it is hard to account for his reputation for superior intelligence. In the personal experience of the writer are several incidents which certainly cast grave suspicion upon this reputation. An encounter near Worcester, Mass., I cannot forget. I was on my way to Boston on a little gasoline machine and had reached a point about eight miles out of Worcester, when as I swung into a long straight section of road, I noticed a horse and wagon drawn up across it, the driver evidently engaged in shovelling out his load. The horse occupied about half of the road. The grade was one of those long gentle slopes which a gasoline machine so delights in, and I saw at once that unless I spoiled a delightful coast and lost much time I would, in about one minute, pass directly under that projecting equine nose at a very lively gait. From past experience I could imagine the result.

To avoid trouble if possible, I rang my bell furiously coming down the stretch, but failed to attract attention. I then lifted my voice, for time was getting short, and finally succeeded in attracting the attention of the shoveller in the back of the wagon. I at once pointed vigorously to the narrow space in front of the horse, to let him know that it might be expedient for him to prepare for any manifestation the horse might make at my passage. The mental status of the driver, however, was not equal to the occasion, for he simply straightened up, adjusted his shovel so that he could lean comfortably upon it and prepared to watch me go by. In less time than it takes to tell it, I was close upon him, going like a bird. As a last resort, I redoubled my vocal efforts and did everything I possibly could to direct his attention to the dangerous position of his horse. My only answer was an approving grin. The horse, apparently a poor decrepit beast, totally lacking in spirit, appeared to be sunk in the most profound meditation.

In an instant, I saw I had to make the best of it, and not wanting to risk too much on the embankment at the other side, I cleared the horse's nose only by a scant margin. Once passed, I gently swung into the center of the road again and, seeing that the way ahead was clear, glanced back. The sight that met my eyes was remarkable. I may have been going twenty miles an hour when I passed under the beast's nose, and his sensations may be readily imagined. He woke from his meditations with a suddenness to which he was wholly unaccustomed and found himself in a whirl of dust. His intelligence then made itself felt. He evidently carefully weighed the matter in mind, and decided that the proper procedure was to withdraw from the scene at as near the same speed as possible, and in the same direction in which everything about him seemed to be going. In an emergency of this kind, it was but natural to assume that the direction taken by the majority of things was the best. He accordingly put his

conclusion into instant effect, and proceeded to tear down the road after me with all the fire of a two-year-old in his first event.

His sudden departure was plainly not counted upon by the driver, for as I looked, tailboards, shovels, manure, dinner-cans and coats were dropping off the end of the wagon one by one, and as I turned the curve at the end of the straight way, I could see something which looked decidedly like a human body being bumped about in the bottom of the wagon while trying to get forward and assume control.

How it all ended I am not able to tell. I of course regretted that I had been the cause of any disturbance on the public highway, but I had done everything reasonable in the premises and was unable to stop on account of approaching darkness.

Another incident occurred as I was returning from Boston two days later on my way back to Hartford. I was running through a long stretch of woods which lies in the mountainous district between West Warren and Palmer, Mass. The road consisted of a series of stiff climbs and quick descents, and was barely wide enough for two carriages to pass. In the worst place I met a carriage coming in the opposite direction. At best I knew I would have to run close to the horse in order to pass, so I slowed my engine down to its lowest speed and, as the grade was about level, threw in my high gear to cut the noise down to practically nothing. I made all these preparations as conspicuously as possible, in order to show the driver that I was willing to make any concession that the circumstances required. My encounter turned out to be a junk dealer, evidently on his regular round among the little villages in that part of the State. His entire outfit was the most striking example of antiquity that it has been my fortune to see in regular service. To my surprise, however, his horse, evidently the most aged relic of all, suddenly gave signs of most energetic life within, and as the poor old Hebrew in command appeared to be suddenly thrown into a ghastly state of terror, I thought best to pull out of the road into the bushes and stop my engine. I did this fully a hundred feet ahead of the horse, but my innocent act was evidently construed by this "intelligent" beast as a move of the most hostile intent, for he commenced to dive and plunge, then for a time assumed a pose of most alert watchfulness, and finally proceeded to dive and plunge again. At each spasm of diving and plunging, he paused to note its effect upon me.

Recognizing a difficult case, for the chattering, gesticulating old Jew seemed to have a more scanty endowment of sense than his horse, I stepped out of my machine and went forward to lend a hand. It should be remembered that my carriage was a very small one, was standing absolutely still, partly hidden by the bushes, and looked in every way like an ordinary open buggy standing at the side of the road. I took hold of the bridle and used the methods usually adopted in such cases, and, these failing, I suggested to the driver that he come down and take his horse by the head and lead him along. The old fellow was most intensely excited, for he trembled from head to foot as he got out of his rig and came forward. In a manner indicating the most abject fear he gingerly took hold of the horse's bridle, and between us we started him forward. We would get about ten feet and then would have to submit to another violent frenzy of bucking. This continued until we came about abreast of my vehicle, when, as though to give the thing a proper greeting, the animal gave a continuous performance. All four feet would leave the ground at once, and he seemed now upon the point of standing upon his head and then upon his hind legs. This grotesque dance continued

until we got thirty or forty feet past my machine, when the horse, seemingly making up his mind that he had had his fun, suddenly calmed down and left us to survey the damage.

The harness, composed principally of rotten old straps and rope, was in a very bad state after this exhibition. I had to take twine and wire from my own repair kit and stand by for about twenty minutes assisting to get things into such shape that the owner could proceed.

The whole affair was entirely uncalled for, and there was every indication that the "intelligent" beast appreciated all along that there was no real danger. I do not know whether other automobilists have noticed this or not, but I on several occasions have had experiences with horses when there was every evidence the beasts were manufacturing out of whole cloth a large share of their excitement.

On another occasion I was running down from Springfield to Hartford on a large gasoline tricycle. Going up a long hill, just south of the town of Windsor, I passed an empty hay wagon coming down. There were evidences early in the proceedings that the horse proposed taking an active part in the matter. The driver however, as in the case of the man near Worcester, directed his entire attention to watching me pass. My speed was very slow, and the noise of the vehicle was practically *nil*. When within about fifty feet of the horse the latter commenced to edge to the other side of the road, when the driver noticing it, threw the reins around a projection of the hay rick, and went to the back of the wagon to pick up a large pitchfork. He then came forward to use it on the horse in an endeavor to bring him to his senses. The driver's interest, however, was still mainly in the tricycle, for he carelessly took hold of the pitchfork near the tines and, while watching us, swung it aloft in one hand, and brought it down with a resounding whack upon the back of the horse. The lines, it should be remembered, were not in his hands, and he was directing toward us his best attention.

The horse, assuming that another enemy of the same kind as the one in front had attacked him in the rear, gave a sudden start and proceeded down the hill in much the same manner as the poor old horse east of Worcester. The driver immediately found himself in a heap on the bottom of the hay wagon, and as the team passed us going down the hill, there was a confused vision of wriggling arms, legs, man and pitchfork.

Many other people have probably had similar experiences with silly horses and stupid drivers, and have also wondered that some people side so determinedly with the party really at fault.

HIRAM PERCY MAXIM.

A Simple Sparking Device.

E. H. Lyon, Englewood, N. J., who is the owner of a gasoline wagon, has been using successfully for some time past a simple substitute for the ordinary sparking dynamos and costly batteries. It consists of a compact plunge battery of four cells, which gives a vigorous spark, cannot get out of order, and is easily renewed. The jars are 2 x 3 inches inside, and the element is composed of three plates, a zinc plate between two carbon plates.

When he starts out he lowers the elements into the solution, and when not running he lifts them out, thus saving the active materials. Mr. Lyon finds that he can run eight or ten hours on one charge at a cost of only four cents. It is wise, he thinks, to take along a small phial of bichromate of potash

and sulphuric acid, so that in case the solution becomes exhausted it may be renewed. But if no supplies of this kind are in the wagon they may be obtained at small cost at any drug store.

A suggestion which he draws from experience is that the air which is drawn into a gasoline engine to form the explosive mixture should be warm air, to prevent odor in the exhaust, and to increase the power of the motor.

As for tires, he believes a thick tube best, so that if a puncture is taken the deflated tire may be used without injury.

The Hoof the Road Destroyer.

In the last number of *Municipal Engineering* Thomas Conyngton says in regard to the destructive effect of horses' hoofs on pavements and roads:

"The most interesting phase of this question is, however, the effect produced by the general use of motor vehicles upon the ever-present and very important problems of street paving, maintenance and cleaning. At present the effect of the horse's hoof on paved surfaces is one of the most serious difficulties confronting the municipal engineer. If an effectual method of destroying our streets were desired, it is doubtful whether anything better could be devised than the hammering, cutting, twisting and grinding of a horse's feet. Take a ponderous draft horse, weighing close to a ton, shoe his four feet with heavy, sharp-cornered, iron plates as a traction base, harness him to a truck, put on a heavier load and then start him pounding, denting, twisting and scraping from morning to night and you have a very efficient engine of destruction. All of our paving construction is largely affected by this factor. The granite block pavement, with all its variations, has no other *raison d'être* for its existence. Asphalt, paving brick and the other modern pavements are very greatly modified by the necessity of guarding against the destructive action of the horse's hoof.

"Nearly all the repairs required by the modern pavement are due to this cause, and in a lesser degree to the iron-tired wagon wheels with their angular edges. The hardest granite blocks grind off until too uneven for use and are then either re-surfaced with asphalt or relaid. Paving brick wear out, and where there is the slightest softness go to pieces. Wherever a weak spot occurs in the asphalt, it is found out by the hoofs of horses, and the pavement is only preserved by the most constant maintenance; while macadam streets and roads can hardly be maintained in even tolerable condition."

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of **THE HORSELESS AGE**, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

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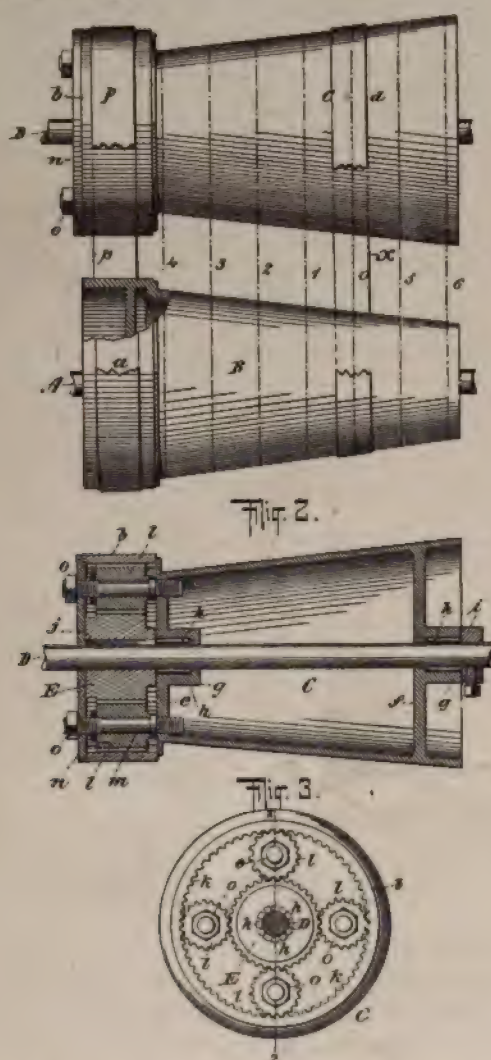
MOTOR VEHICLE PATENTS

of the world

EDITED BY W. H. GRAHAM.

No. 621,436. Power Transmitting Device. Henry W. Struss, New York, N. Y. Application filed May 5, 1898.

Fig. 1 is a plan view, with portions broken away, of a sufficient number of parts to illustrate one form of power transmitting mechanism embodying the invention. Fig. 2 is a central longitudinal sectional detail view of the driven drum or pulley, said section being taken on the line 22 of Fig. 3; and Fig. 3 is an end view of the same, looking in the direction of the arrow in Fig. 2.



The shaft A is the main driving shaft, which may either be directly operated by the motor or connected with it by any suitable intermediate mechanism. To this shaft a cone pulley or drum B is fixed, so as to rotate therewith, and the pulley is provided, in addition to a conical belt-supporting face,

with a cylindrical belt-supporting face a, which is shown to extend from the base of the cone. A second pulley or drum C co-operates with the pulley B and is connected therewith by belts in a manner which will hereinafter appear. The pulley C, illustrated in detail in Figs. 2 and 3, is preferably of the same size and contour as the pulley B, except that the cylindrical pulley-section b is adjacent to the head of the cone instead of at the base thereof.

The conical section d of the pulley C and the cylindrical section b thereof are, in fact, two separate and independently movable pulleys. The conical pulley d is provided with heads or spiders e f, each of which may be provided with a bearing g, in which are contained antifriction rollers h, that are adapted to contact with the shaft D, termed the driver shaft, and which may be connected to the traction-wheels or other parts to be operated. A collar i may be secured to the shaft by means of a set-screw to maintain the rollers in place in their bearing in the head f, while a gear-wheel E maintains the rollers in place in the bearing in the head e. The gear E is a driven gear which is connected to rotate with the shaft D by means of a feather j or otherwise.

The cylindrical pulley b is provided with an internal gear-face k, which is adapted to engage a series of idlers l, the shaft m of each of which is supported at one end by the head e of the conical pulley d and at the other by the head or plate n, which is supported by the shaft D and is prevented from lateral movement by the nuts o. By these means the gearing is housed and a firm support afforded for the shafts of the idlers.

In carrying the invention into practice a belt p connects the cylindrical portion a of the driving-pulley B to the cylindrical pulley b, though these parts may be otherwise connected, as by means of a chain or gear, and motion may be thus communicated to the idlers l and from the idlers to the gear E, which transmits motion to the shaft D and by the shaft to the traction-wheels or other part to be moved. Another belt x connects the conical portion of the pulley B with the pulley d, and the speed and even the direction of rotation of the shaft D is determined by the location of this belt x on the pulleys. To illustrate this, let it be assumed that the pulley B is driven at the rate of 600 revolutions a minute, that the diameter of the gear k is eight inches, that the diameter of each of the idlers l is two inches, while the diameter of the gear E is four inches. Let it be assumed that when the belt is in the position indicated by the line O the normal is obtained, and that the drum C will be driven at a speed of 400 revolutions a minute, and that the speed at which the idlers l are moved around with the drum C will be such with relation to the speed imparted to the idlers by the gear k that they are ineffective to transmit motion to the gear E, and consequently to the traction-wheels, so that while the motor is running at full speed the vehicle will not be moved. As the belt is shifted to any of the positions indicated by the lines 1, 2, 3 and 4, motion is transmitted to the driven shaft and the traction-wheels connected therewith, because of the higher rate of speed transmitted to the drum C, the highest rate of speed being attained when the belt is shifted to the position indicated by the line 4. When it is desired to reverse the movement of the vehicle, it is merely necessary to shift the belt to the opposite side of the normal position or to one of the positions indicated by the lines 5, 6, when the pulley C and the idlers l will be moved around at a slower rate of speed than the normal, or at the rate of, say, 300 revolutions, and the shaft D will be rotated in the opposite direction.

This rotation in the opposite direction is due to the fact that the drum C, which carries the idlers I, is traveling at a rate of speed—say 300 revolutions at the line 6—which will permit the gear k to transmit a rotary motion to the idlers, which motion is in turn transmitted to the driven shaft D and to the traction-wheels connected therewith.

Instead of employing the shaft A as the power transmitting or motor shaft, power may be applied to the shaft D, when the shaft A will become the driven shaft.

Design No. 30,551.—Vehicle Body.—Uriah Smith, of Battlecreek, Mich. Patented April 11, 1899.

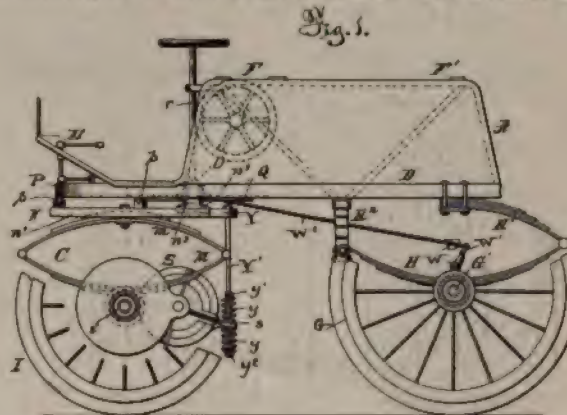
No. 623,149.—Motor Road Vehicle.—H. C. Hart, of Detroit, Mich. Patented April 18, 1899.

The engine is placed under entire control of the motorman by means of the pedal h, the reciprocation of which draws a supply of explosive mixture into the pump cylinder a, from the atmosphere and carbureter D, and then compresses and forces it into the cylinder I, behind the piston J, where it is exploded by an electric spark, driving the piston forward against the tension of the spring S, and turning the pulleys G and H only. At the outer end of the stroke of the piston the exhaust valve T of the cylinder I is opened, and the spring S then returns the piston to its first position, rotates pulleys G and H, and by means of the latter pulley and clutch U, rotates the shaft E and wheel C, thus driving the vehicle forward. At the end of its return stroke the piston comes to rest and remains stationary until the operator forces a fresh charge of explosive mixture into the cylinder I from the pump a. The ignition of the charge is effected by closing an electric circuit at the contact points r, by means of a connecting piece on the arm g, of the pedal. The ignition occurs after the compressed mixture has been forced into the gas cylinder. The time and length of the stroke of the engine is dependent upon the stroke of the pump, and the speed and

power of the engine are always in proportion to the exertion of the operator.

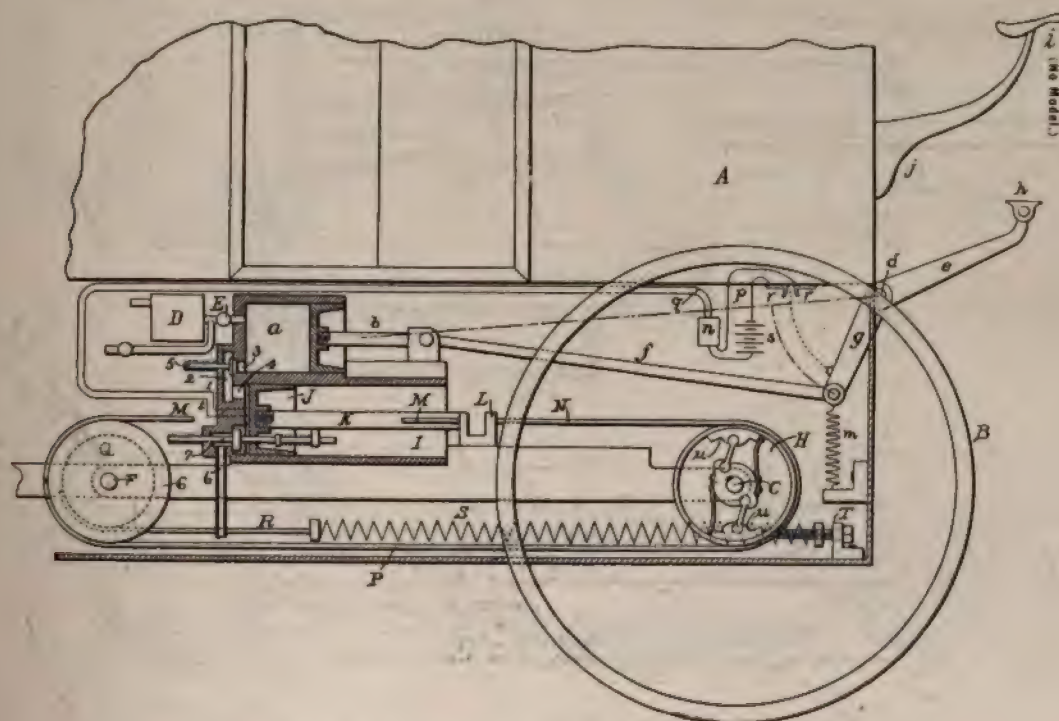
No. 623,383.—Motor Vehicle.—Francis A. Pocock, of Philadelphia, Pa., assignor by mesne assignments to the Electric Power Development Co.

One of the features of the invention consists in a vertical axle about which the front gear turns and situated on a line considerably in the rear of the front axle. The inventor states



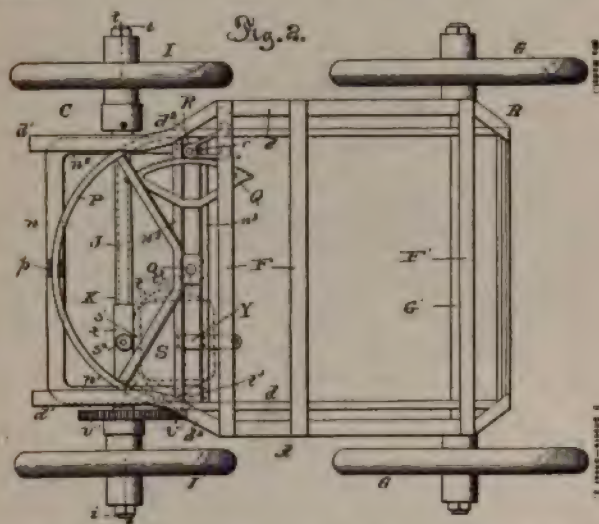
that as a result of this construction the vehicle tends to bring the rear wheels into proper alignment, relative to the front wheels—an end which cannot be reached when the steering axis is in the plane of the front wheel axis, particularly when the propelling power is applied to the front axle, as in this machine. He also states that when the pivot O is behind the front axle but little power is required to turn the segment Q and the front gear.

The front wheels, I, are mounted on spindles on the ends of the axle bar J, which is rotary, and in turn is mounted in



MOTOR ROAD VEHICLE. H. C. HART, DETROIT, MICH.

a stationary tubular support K, carrying at its ends brackets L, which are attached to an oscillating frame N, supporting the vehicle body by the usual elliptic springs. The ends of the tube are also formed with ball bearings for supporting the axle within the tube. Clutches U2 are provided for clutching each wheel to the axle, and for serving as a differential gear.



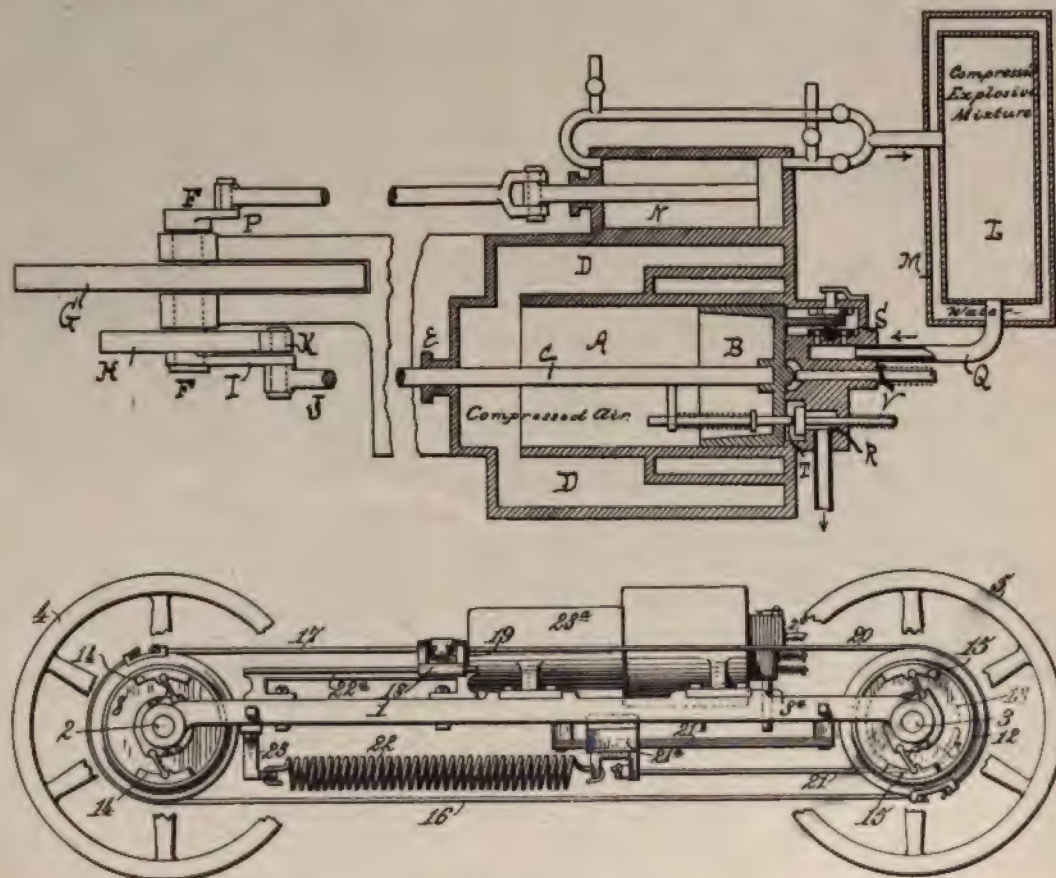
Upon the tubular support K, independent of the axle, there is secured the motor carrier T. This has a tubular part t,

carried about the tube K, above described. From the tubular part there project back arms t1, in the rear ends of which are formed boxes for receiving the armature shaft. The casing of the motor S is suspended at one side from the tubular part t, and at its other side by a spring support consisting of a rod Y1, whose upper end is securely fastened to a plate or bar extending rearwardly from the frame M. Upon opposite sides of the lugs by which the motor is suspended the rod is provided with springs y, which serve to yieldingly hold the motor in position whether it is forced upward or downward. The motor shaft is geared to the axle by the usual large gear and pinion, and is provided with a brake mechanism operating upon the brake hub inside of the large gear. The motor and its connections oscillate with the axle as the vehicle is steered, and the axle and motor are connected with the rotating frame N, which is connected with the body frame by a pivot bar O.

The claims are forty-one in number.

No. 623,224—Gas Motor Engine.—E. J. Stoddard, of Detroit, Mich., assignor to the Henry C. Hart Manufacturing Co., of same place. Patented April 18, 1899.

The invention lies in certain combinations with a "free-flying-piston gas-engine" of two shafts 2 and 3, having respectively pulleys 8 and 12 connected by a flexible connection 16, which is attached also to a cross head 18, of the engine 23a. The pulleys are adapted to engage with their respective shafts by clutches 14 only when the pulleys and flexible connections are moved in one direction, so that the shafts are free to revolve in the pulleys on the return move-



GAS MOTORS OF E. J. STODDARD, DETROIT, MICH.

ment of the flexible connection. In the forward movement of the pulleys and their connections the motion is caused by the power of the engine, while the return movement, during which the shaft is engaged by the pulleys, is effected by a spring 22, attached by a connection 21 to a small pulley 13, upon one of the shafts. A balance weight is also attached to the spring and its connection 21, in order to secure practically noiseless action, and to equilibrate the motion of the engine, particularly during the forward flight of the "free-flying-piston."

No. 623,190.—Explosive Engine.—E. J. Stoddard, of Detroit, Mich. Patented April 18, 1899.

Means are provided for compressing and cooling the explosive mixture in the reservoir L, from whence it is admitted as required to the working cylinder A through a device S, operated by a projection on the back of the piston B. The crank pin does not make a revolution upon each reciprocation of the engine, but rocks with a lever I back and forth upon the shaft and engages by a clutch K with the crank disc H only when it moves backward toward the engine.

The outer end of the cylinder K is in communication with an angular chamber D, the two together being made airtight, so that as the piston B moves outwardly the air therein is compressed and serves as a spring to return the piston to its inner position and to rotate the driving axle. The inventor states that the explosive mixture is cool at the time it is fired, and that therefore the initial pressure is much higher than if the mixture retained its heat of compression. The pressure being higher, the rate of transforming the heat energy into work is of course proportionally greater with the same velocity of the piston; but in this form of engine the piston velocity is proportional to the pressure upon it, so that by the use of a cold compressed explosive mixture the maximum explosive pressure and the maximum piston velocity are obtained—that is to say, a maximum rate converting the heat energy into available work—while the area of the cylinder walls to the unit of explosive mixture is a minimum.

QUESTIONS AND ANSWERS.

At the request of many of our readers we have decided to open a department of questions and answers. We will endeavor to answer any detail question in practical engineering pertaining to motor vehicles.

Answer to W. R. Bullis, Chatham, N. Y.

The battery used on the De Dion machine is a primary one, and the coil is of the high tension kind, producing a jump spark. The price of these batteries is \$10 apiece, and their life about 200 hours. So far as the editor knows these batteries and coils can be obtained here only of the American Motor Co., New York, or Kenneth A. Skinner, 122 Massachusetts avenue, Boston, Mass.

The jump spark seems to have the preference in Europe, while the wipe spark is most used here.—Ed.

The Timing Valve.

LOWELL, MASS., April 17, 1899.

Editor HORSELESS AGE:

Please explain in your query column what a timing valve is, and whether one is necessary on all gasoline engines.

T. McNAMARA.

How Motor Vehicles Stand Before the Law in New York State.

A subscriber of the legal profession furnishes the following extracts from the laws of New York State, construed to affect the use of motor vehicles:

The first provision affecting above is found in the laws of 1886, chapter 269, section 1, sub-division 293, as follows:

293. Vehicles propelled by steam on highways. It shall not be lawful for any owner or owners, or the servant or agent of any owner or owners of a carriage, vehicle or engine propelled by steam, to allow, permit or use the same to pass over, through or upon any public highway, road or street, unless such owner or owners or agent or servant shall send before the same a person of mature age at least one-eighth of a mile in advance to notify and warn persons traveling or using said highway, road or street with horses or other domestic animals, of the approach of such carriage, vehicle or engine, and at night said person to carry a red light, except in incorporated cities and villages. Also

294. Violation of last section. Any person violating the provisions of this act shall be guilty of a misdemeanor and liable for any damages sustained by any person or persons traveling or using said highway with horses or domestic animals as aforesaid.

These provisions were substantially incorporated in section 155 of chapter 568 of the laws of 1890. This provides as follows:

Steam traction engines on highway. The owner of a carriage, vehicle or engine propelled by steam, his servant or agent, shall not allow, permit or use the same to pass over, through, or upon any public highway or street, except upon railroad tracks, unless such owners or their agents or servants shall send before the same a person of mature age, at least one-eighth of a mile in advance, who shall notify and warn persons using or traveling such highway or street with horses or other domestic animals of the approach of such carriage, vehicle or engine, and at night such person shall carry a red light, except in incorporated cities and villages.

Here there is no penalty provided for violation of the foregoing provision. This, however, in all probability, would be remedied by virtue of section 32 of the laws of 1892, chapter 677, which provides as follows:

Effect of repeal and re-enactment. The provisions of a law repealing a prior law which are substantially enactments of the provisions of the prior law, shall be construed as a continuation of such provisions of such prior law and not as new enactments. If any provision of a law be repealed and in substance re-enacted, a reference in any law to such repealed provision shall be deemed a reference to such re-enacted provision.

Further, there is nothing to show that sub-division 11 of section 640 of the Penal Code has ever been repealed or modified in any way. This provides as follows:

Malicious injury and destruction to property. A person who willfully drives or leads along a public highway a wild and dangerous animal or a vehicle or engine propelled by steam, except upon a railroad, along a public highway, or causes or directs such animal, vehicle or engine, to be so driven led, or to be made to pass, unless a person of mature age shall precede such animal, vehicle or engine, by at least one-eighth of a mile, carrying a red light, if in the night time, and gives warning to all persons whom he meets traveling such highway, of the approach of such animal, vehicle or engine, shall be deemed guilty of a misdemeanor.

The Eames Motor Vehicle Drive Wheel.

The accompanying illustration shows an improved drive wheel for motor vehicles, which A. M. Eames & Co., South Framingham, Mass., have perfected after much thought and experimenting. One objection which they make to the wheels



on most wooden-wheeled motor vehicles is the flaring-out appearance, which has been entirely removed in this wheel.

They are furnishing wooden wheels for both light and heavy vehicles.

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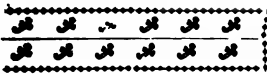


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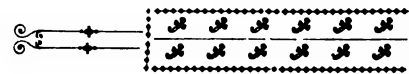
MAY 3, 1899

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EVERY WEDNESDAY



In the
Interest of the
Motor Vehicle Industry.

ESTABLISHED 1895.



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THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

Vol. IV.

NEW YORK, MAY 3, 1899.

No. 5.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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**On account of the excessive discounts charged
by New York banks on small checks under their
new rule, subscribers are requested to remit by
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Motor Vehicle Trust.

The daily papers inform us that a motor vehicle trust is being organized to control the manufacture and sale of all classes of vehicles in this country. The names of some of the best known financiers in the United States are coupled with these statements, men who are quick to take advantage of any prospective field like that offered by the motor vehicle, and whose names are considered a guarantee of success.

It is true that some of our leading capitalists, chiefly street railway magnates, have lately interested themselves in the development of the motor vehicle industry, and that plans have been laid for as rapid an extension of it as unlimited capital and able engineering can accomplish. It is also true that to effect these arrangements consolidations have been made of various minor interests, thus forming stronger companies, backed by the necessary patents, business capacity and capital to cope with modern industrial conditions. This is in-

variably the procedure in the formative period of new industries of sufficient promise to enlist large capital, but these are but preliminary consolidations. The period of the trust has not come yet. The industry is too new, patents relating thereto of too limited a character, and the possibilities of improvement too great to make a successful trust possible now. The first period will be one of rapid growth and strong competition between powerful rivals. Any trust that is undertaken at this early day will be a good thing for investors to let alone.

Damages Claimed from Motor Vehicle Owner.

The first damage suit in New York State, in which the alleged offending object was a motor vehicle, is now on trial at Rochester, N. Y. Although the damages claimed were nominal, the defendant decided to fight the case, to establish a precedent that might serve as a guide for other operators of motor vehicles in this State.

The carriage which was said to have been the cause of the runaway was propelled by steam and is described in the plaintiff's complaint as a noisy, dangerous contrivance, likely to frighten horses, etc., which leads to the conclusion either that the suit was brought under the nuisance laws or the attorney made a very loose and irrelevant interpretation of the New York laws in reference to self propelled vehicles, published in our last issue. There are numbers of noisy contrivances, likely to frighten horses, which are in common use on or near roads, and which often do cause runaways, yet cannot be considered nuisances under the code.

From the digest of the law relating to the use of motor vehicles on common roads, given in our last issue, it appears that the steam vehicle alone is under onerous regulations in this State, electric and gasoline vehicles not being specified in the act. While the law has never been construed by a court,

the meaning of these obsolete statutes apparently is that a steam carriage must be preceded at a distance of an eighth of a mile by some person of mature age to give warning of its approach, and that any person who conducts a steam vehicle on the highway without this precaution is guilty of a misdemeanor and is subject to damages, the law implying that such a person is guilty of "negligence *per se*," i. e. in the fact itself. Consequently no evidence of contributory negligence would be required, and in the case above referred to the damages could have been collected without doubt, if the complaint had been properly drawn, simply because the carriage was propelled by steam. A gasoline or electric carriage would not come under the ban of the law.

This law, so long dormant on the statutes, undoubtedly had particular reference to traction engines, road rollers, etc., for at the time it was enacted no electric or gasoline vehicles were known, and the few experimenters in steam road locomotion were regarded as cranks or public nuisances. Its manifest unfitness to meet the conditions of the dawning horseless age justify us in drawing attention to it, that it may be the more quickly expunged from the statutes. Perhaps a few fines under the law would be beneficial in the end, according to the well-known maxim that the best way to have an obnoxious law repealed is to enforce it.

A subscriber who has ordered a steam carriage, which he expects to use in this State, says that he will buy the noisiest and most disagreeable gasoline carriage he can find and send it on ahead to notify the people that there is a quiet and dainty little steam carriage coming along just an eighth of a mile behind.

Stables Breeders of Disease.

It used to be supposed that stables were healthy places, and that those employed in caring for horses were more robust and freer from ordinary ailments than other men. Dainty ladies sometimes went to inhale the odors of the stable as they would take a sun bath or visit the pine forests, under the impression that there was healing in them. But modern science has dispelled this illusion and shown that on the contrary stables are breeders of that type of diseases called zymotic, which are noticeably prevalent in close proximity to them and decrease in intensity as the circle of the distance from them widens.

The discovery of the injurious effect of stables upon the public health was first made by the actuaries of the big insurance companies, who, in studying their vital statistics, remarked that zymotic diseases were much more frequent among livery stable keepers and employees than among those of other vocations. Pursuing their investigations further they found that those who resided contiguous to stables were afflicted with the same class of ailments, though in less degree, and

that the same tendencies showed themselves in decreasing percentage as the distance from these sources of infection increased. Having verified the theory to their complete satisfaction the insurance companies appealed to the board of health (first in Brooklyn, N. Y.) to investigate the nuisance.

It was found that owners of stables had grown very careless in regard to the removal of the refuse of the animals, which was allowed to accumulate for weeks because of the old delusion that the waste matter from horses was not detrimental to health. Regulations were passed by the board compelling stable owners to remove the excreta more frequently, and to thoroughly cleanse and disinfect their premises.

As a consequence of this agitation some improvement is said to have been noticed in the health of those residing near the stables. But the nuisance will not be wholly abated until the great beasts whose refuse litters the streets and fouls the atmosphere in our populous centers, are banished from the cities to the agricultural districts, where they will find temporary harborage. Later they will be relieved of much of this drudgery, too.

Dashboards.

Whether a dashboard is necessary on a motor vehicle has been a mooted question. Many contend that when the horse is removed the dashboard should disappear with him, inasmuch as its chief use is to shield the driver from the mud and water thrown back from the horse's hoofs.

While it is true that there is in a motor vehicle no further need of protection from the horse and his mud throwing hoofs, it seems to us that the dashboard has other important uses. It is a shield from the wind, which in cold and stormy weather cannot be sufficiently tempered by the ordinary lap robe, and, in case of accident it may serve as a fender to ward off shocks and a support to prevent the occupants from being thrown forward onto the ground.

Let us think twice before we discard the dashboard entirely.

Race and Competition.

There is disagreement between the two contestants in the proposed motor tricycle race from New York to Boston as to the points on which the contest should be decided, the De Dion champion insisting that a race should be decided by speed alone and that separate contests should be held to settle the other points of manageability, noiselessness, simplicity, etc. The other side apparently wishes the latter points considered in the race, although how this can properly be done except by the separate competitions suggested by Mr. Skinner, is not plain. A race is one thing, a competition another. A race refers to speed and that only; a competition is a broader

contest, referring to other points of excellence and often excluding speed altogether. To be perfectly explicit such a contest as Mr. Fischer wants should be described as a race and competition. The other points he insists on are more important than speed and should carry due weight in judging of the merits of the two machines, but the winner of a race is the one who reaches the goal first.

Alcohol vs. Petroleum.

Judging from the record of the recent race for alcohol motors from Paris to Chantilly and back the petroleum motor is not likely to be displaced by the alcohol motor. The amount of spirit consumed during the run was about three times as great as would have been required had petroleum been the fuel used, and the bystanders at the start report a decided pungent odor from the alcohol motor.

The duty on alcohol is high in France, and some believe that if it is removed alcohol will supersede petroleum for power and lighting purposes. Tests, however, fail to bear out any such conclusion. Alcohol is inferior in heat units, and is therefore less economical.

Special Writers Wanted.

The editor wishes to engage special contributors for THE HORSELESS AGE, and would like to correspond with parties who feel competent to write on topics relating to the motor vehicle industry.

Some of the daily newspapers in various sections of the country are discussing regulations for motor vehicles. The Cleveland (O.) *Leader* advocates a speed limit and compulsory lights at night. To reasonable regulations like these motor vehicle manufacturers and users can take no exception.

Officers of the Columbia Automobile Co.

It is currently reported that the newly organized Columbia Automobile Co., of Hartford, an enlargement of the motor carriage department of the Pope Manufacturing Co., elected officers in New York last week as follows:

President, Colonel Albert A. Pope, of Boston; vice-president, George H. Day, of Hartford; secretary and treasurer, Harold H. Eames, head of the motor carriage department of the Pope Manufacturing Co. Among the directors are William C. Whitney, P. A. B. Widener, of Philadelphia; Stephen B. Elkins, G. B. Schley, of Moore & Schley, the bankers; Colonel Pope, George H. Day and Harold Eames.

It is said to be the company's intention to organize branch companies in the large cities and towns of the country, which companies will purchase vehicles from the parent manufacturing company. Stock in these subsidiary companies, it is said, will be offered for sale to the general public.

Part of the plan of the big syndicate will be to establish charging and repairing stations, where required. It is incidentally stated that gasoline vehicles will also be manufactured.

Duryea Model for 1899.

The accompanying cut shows the first of four different styles of vehicle which the National Motor Carriage Co. are bringing out. It is a touring cart, weighing about 800 pounds and propelled by a five H.P. motor.

The wheels are thirty-two and thirty-six inches, instead of thirty and thirty-four, as on the Duryea of 1898. The track is 4 ft. 8 in.

The motor has two cylinders, set tandem with crank shafts at 180°. Noise, vibration and odor are reduced to a minimum.

Cooling water is carried in concealed side panels, the heat being radiated from it by draughts of air both inside and out, so that it is said no steam shows even after a long run.

All wearing parts are protected by dust proof cases.

The speed of the carriage, from zero to thirty miles an hour, is regulated by the speed of the motor, which is controlled through the intake, from 150 to 900 revolutions per



minute. Power is transmitted by gears to a countershaft, operated by friction clutches, and thence by sprocket and chain to the rear axle. There are three forward gears and one reverse, representing different grades of power, for as has already been said, the speed of the vehicle is regulated by the intake. The change from one gear to another can be made at full speed without jar or noise. The clutches are controlled by a single lever on the left hand side, and the speed of the motor is regulated by a button in the top of the speed lever.

The steering mechanism is the same as in the 1898 model, the lever being placed in the center of the seat.

The motor is started by a foot lever from the seat instead of by a crank at the side of the vehicle, as was the case in the 1898 model. In order to prevent thieves or mischievous persons from running off with the machine if the owner leaves it standing in the street or elsewhere, a safety plug completing the electric ignition circuit is inserted just back of the steering post.

Two inch solid tires are employed in the touring cart, though the other styles—a trap dos-a-dos, phaeton and physician's Stanhope, will be fitted with two and one-half inch Diamond pneumatics.

E. O. Williams, Syracuse, N. Y., is working on an electric carriage of his own design.

Damage Suit in Rochester, N. Y.

A very interesting suit for damages is now on trial at Rochester, N. Y., in which the plaintiffs are Mason Bros., proprietors of a laundry in the Flour City, and the defendant is Jonathan B. West, inventor of a steam carriage that he has been running about the city for some months past. The amount of damages claimed is \$49; \$11 damages to the wagon and \$38 for depreciation to the value of the horse through the spoiling of his disposition, and the ground of the damages is that the vehicle driven by Mr. West is "a noisy, dangerous contrivance likely to disturb and frighten horses." Mr. West makes the following statement:

"On November 18, 1898, I came near a laundry delivery horse left standing at the curb while the driver went into the house to deliver goods. I saw the horse prick up his ears as though he might be frightened, and turned my vehicle to the opposite curb and stopped still, and of course then made no noise whatever, but after about ten to fifteen seconds the horse concluded to have some fun and started towards my vehicle, passed it and soon afterward collided with a hydrant, then proceeded for half a block and was caught.

"In their evidence they show (or pretend to) that I did not stop, that I was going at a high rate of speed, and that as there was a man on the vehicle beside me, I was grossly negligent.

"My side has shown that I had a good right to be there, that I showed proper caution in stopping fully three rods from the horse, and that Mrs. West was on the vehicle with me instead of a man, as two of their best witnesses testified. We showed, too, that the horse had run away on two previous occasions.

"I suppose it would have cost me less to have paid their claim, but I did not like to establish a precedent, and so be expected to pay everyone who should present a claim.

"It is considered by the attorneys in the nature of a test case. If it goes against me I shall appeal."

Arrangements Made for the Care of Electric Carriages at Summer Resorts.

The Pope Manufacturing Co. have made arrangements for the care of their electric carriages at Narragansett Pier and Newport, R. I. A number of the summer residents in both places own Columbia electrics, and accordingly arrangements were entered into with the Newport Illuminating Co. and the Narragansett Pier Electric Light & Power Co. to furnish facilities for recharging batteries. A portion of the livery stable of Edward G. Hayward, of Newport, was also secured for a central station.

Exhibitors at the Electrical Exhibition.

Five electric vehicle concerns have taken space at the New York Electrical Exhibition, to be held at Madison Square Garden this month: The Pope Manufacturing Co., the Riker Electric Motor Co., the Indiana Bicycle Co., the Woods Motor Vehicle Co. and the American Electric Vehicle Co.

Cab Station Purchased in Boston.

The old Cyclorama Building on Tremont street, near Clarendon street, has been sold to the New England Electric Vehicle & Transportation Co., of Boston Mass., to be used as a cab station. Additional land has also been purchased adjacent to the cyclorama.

The round shape of the building renders it well adapted to the purpose of the storage, care and charging of electric vehicles. Several cabs are already in operation, and the new building is expected to be ready for occupancy by early fall.

Second Motor Cab Contest.

On June 1, another series of motor cab trials will be held in Paris, similar to those organized last year. The same routes, thirty-five miles in length, will be used, and the same standards of judgment will decide the contest.

There will be three classes of contestants: Passenger cabs, delivery wagons carrying five tons and light delivery wagons in charge of one man. Up to the 15th of May the entry fee is 200 francs; after that date the fee will be doubled. For the light delivery vans, however, the fees are reduced by half.

No Laws Interfere in Connecticut.

There are in the State of Connecticut no laws interfering with the rational use of motor vehicles upon the highways.

BOOK REVIEWS.

A very timely, very interesting and valuable book, by T. O'Connor Sloane, Ph. D., has just appeared, entitled, "Liquid Air," published at \$2, by Norman W. Henley & Co., 132 Nassau street, New York.

Dr. Sloane is a man of great learning and has a very happy way of presenting in popular vein, to be grasped by the average understanding, the most difficult scientific problems. Like Tyndall, he is no more remarkable for his scientific attainments than for his successful way of telling what he knows. Some of his previous works, "Electricity Simplified," "Electric Toy Making," "Standard Dictionary of Electricity," like the present work on liquid air, contain a great deal that is useful for reference as well as interesting reading.

The present work, "Liquid Air," gives the history of all the important experiments which have been made in the liquefaction of gases, with short biographical sketches of the experimenters. The book is replete with pictures of apparatus which have been employed in the development of the art of liquefaction of gases, culminating in the wonderful feats accomplished by Prof. Tripler, who, with one stroke of genius, has shown the world how to make liquid air by the barrel instead of by the teaspoonful, as heretofore.

Sloane's "Liquid Air" gives much useful information on the latent heats, specific heats, boiling points and other properties of liquid air, liquid hydrogen, and other highly volatile liquids.

HUDSON MAXIM.

MINOR MENTION.

Motor carriages will be introduced at Tuxedo Park, N. Y.

Harry Payne Whitney, son of ex-Secretary Wm. C. Whitney, has purchased a Winton carriage.

A Krieger "forward-axle motor" electric cab has been brought to New York. It is in charge of a French motor-man.

The E. W. De Bow Co. has been formed at Newark, N. J., to make motor vehicle tires. Their office is at 567 Broad street.

John W. Cronin, a livery stable keeper, of Syracuse, N. Y., has ordered a number of the Overman steam carriages for public hire.

The New England Motor Carriage Co., Boston, Mass., have moved their factory at Lowell, Mass., into the Fifield Building, on Fletcher street.

Kenneth A. Skinner, the De Dion agent for the United States, rode from Boston to New York and back last week to pace Waller, the bicycle rider.

The \$500,000 preferred stock of the Lewis Motor Vehicle Co., Philadelphia, was subscribed five times over when the books closed on Monday, April 24.

The Ball Bearing Co., Boston, Mass., have orders four months ahead for motor vehicle bearings and are adding new equipment to meet the demand for these goods.

E. C. Newcomb, electrical engineer for the B. F. Sturtevant Co., Boston, Mass., has designed a marine motor which occupies very little space and is free from vibration.

The Cleveland Machine Screw Co., Cleveland, O., have nearly completed the first Sperry electric carriage, and are making jigs and tools to turn them out in hundred lots.

The Haynes-Apperson Co., Kokomo, Ind., have received an order for a number of motor mail wagons to be used by contractors in carrying mails between the inland towns of Porto Rico.

Geo. W. Lewis, the Chicago inventor, is now in Philadelphia superintending the construction of a number of his gasoline wagons for the Lewis Motor Wagon Co., recently organized there.

J. G. Stone, U. S. Consul General at Cape Town, South Africa, writes that several English and French motor vehicles are in use there for pleasure and for carrying the mails. He wishes to buy a motor carriage himself.

The Columbia Motor Carriage Co., Hartford, Conn., are building an addition 177 feet long, 50 feet wide and three stories in height, to their factory. This company, it will be remembered, is the recently organized motor carriage department of the Pope Manufacturing Co.

W. A. Crowds, inventor of the Crowds storage battery, which was exploited in Chicago two or three years ago, has settled in London, England, and established a factory in Eccleston Square, Pimlico, to manufacture special storage cells for electric vehicles.

The Stockton & Jackson Stage Co., Stockton, Cal., are experimenting with a gasoline motor stage. The route is mountainous in part, and the motor at present employed is not powerful enough to handle the loaded coach on the steep grades, so horses are attached when the mountains are reached. A more powerful motor is being built, however, which will drive the coach over the entire route.

PARIS JOTTINGS.

A company has just been formed at St. Etienne (Rue de la Trefilerie), France, to be known as La Société Manufacturière d'Armes, Cycles et Automobiles. The capital is \$140,000.

The new regulations for motor vehicles in Paris provide that at night each vehicle must carry a white light and a green light, the former on the right and the latter on the left side of the vehicle, so that all the motormen need do in passing each other is to avoid the green lights.

The motor vehicle movement is to come in for a large share of attention at the next meeting of the French Association for the Advancement of Science, which is to be held at Boulogne-sur-Mer from the 14th to the 21st of September next. Several papers on automobile subjects have already been promised, and arrangements are now in hand for the holding of a motor vehicle exposition during the course of the meeting.

Liquid Air.

At a recent meeting of the French Association for the Advancement of the Sciences, M. Dommer announced that Dr. Linde was now engaged on the construction of a small piece of apparatus for the production of liquid air which will weigh less than two and a half pounds, and will liquefy the air in eighteen minutes. With respect to the preservation of the liquid air when once made, M. Dommer stated that with the latest form of vacuum vessel, of about half a gallon capacity, the liquid will take fifteen days to completely evaporate. As the nitrogen of the liquid air boils off more rapidly than the oxygen, the liquid becomes continuously richer in the latter gas, and Dr. Borchers has accordingly used the residual liquid for obtaining the high temperatures necessary for producing calcium carbide without the aid of electricity. By soaking cotton wool in this residual liquid a powerful explosive is produced, which, though it must be prepared on the spot and fired within a limited period, is nevertheless stated to be very cheap, as one pound of explosive can be obtained for an expenditure of one and a half to two H.P. hours. At the Simplon Tunnel Works a plant is being erected capable of producing about one and a half gallons liquid air per hour.

Trade Publications.

When an industry has reached a stage where manufacturers of parts issue special catalogues of their lines pertaining to it, it is a sign of progress on both sides, of the general industry on the one hand and the manufacturer of parts on the other, who is enterprising enough to take time by the forelock and thus early declare his faith and support it by works as the Diamond Rubber Co., of Akron, O., do, whose original booklet on Diamond motor vehicle pneumatics called forth this reflection. The Diamond pneumatic tires for motor vehicles have seen the hardest kind of usage on all kinds of roads, and are pronounced a success by builders and users of motor vehicles. The makers claim for them the following points of superiority:

"The tread is non-expansive, tough and hard to puncture; the sides are constructed to yield the greatest resiliency; the base is equipped with lugs to make attachment to the rim secure, and they will run more miles than any other make." All interested in motor vehicles should send for this booklet.

OUR FOREIGN EXCHANGES.

The Simms Patent Motor Wheel.

This is a light motor vehicle of an entirely new design. Although possessing only three wheels, it cannot be termed a tricycle in the ordinary acceptance of the term, since the driver has a comfortable seat in lieu of the ordinary type of saddle, and has further a footboard on which to rest his feet, instead of the more or less uncomfortable foot rests provided in the motor tricycles of the De Dion type. The front seat is made so as to be easily removed in case the machine is required for one person only, and it may, if desired, be replaced by a carrier, so that the vehicle may be used for either pleasure or light delivery purposes. In light motor vehicles or tricycles, as hitherto constructed, the tendency has been to adapt a motor to an existing type of vehicle, but in Mr. Simms's opinion this method of proceeding is totally wrong. In designing this motor wheel, therefore, he proceeded in exactly the opposite direction—namely, in the first place he designed his motor, which possesses many novel points, and then set himself the task of designing a motor vehicle the frame of which would enable him to place the motor in the most advantageous position to combine great rigidity with safety and comfort. The result has been the elegant little vehicle which he has named the motor wheel in order to avoid any possibility of confusion with the term tricycle, as usually understood.

In the motor itself a great advance is claimed to have been made over the small motors hitherto on the market, inasmuch as the Simms motor is entirely automatic in its action. This has been arrived at (1) by employing magneto-electric ignition, the motor thus producing its own igniting spark, all batteries or heating flames being entirely absent; (2) by obtaining efficient cooling of the cylinder by natural draught only; and (3) by the use of the automatic gasoline feed, which supplies the oil to the motor in correct proportion, at any speed, without interference on the part of the driver. The adjustment of the speed of the motor, and consequently of the vehicle, is effected solely by advancing and retarding the time of ignition, and without any change whatever in the gas mixture by means of the Simms patent timing gear.

The motor, instead of being at the rear, as is the usual custom, is fixed in front, between the front wheels, which in this vehicle are the drivers. This position has many advantages, as it allows a current of air to pass completely around the cylinder, keeping it efficiently cooled, and also the motor being well in advance of the tread of the wheels, it is kept comparatively free from dust and dirt. Owing, moreover, to the motor being placed horizontally and being perfectly balanced, the vibration usually felt is reduced to practically nil. The gasoline tank is fixed in the rear portion of the frame, below the driver's seat, where it is kept at a constant level by means of a float, and, as before stated, is fed automatically to the cylinder in correct proportion at any speed. The tank holds sufficient for a run of about 100 miles. The carriage is provided with two brakes, one a band brake on the driving axle, applied by the foot, and the other an ordinary spoon brake, on the tires of the front wheels, applied by hand. The motor can also be instantly stopped by intercepting the current of electricity from the magneto machine, which is effected by a slight movement of a small ebonite disc immediately under the left hand

of the driver. The car can, therefore, be brought to rest within a very few feet even when proceeding at a considerable speed. The steering is effected by means of a hand wheel on the right hand side of the driver, connected by a rack and pinion motion to the rear wheel, and is very efficient. It is claimed that this arrangement, viz., front driving and rear steering, in addition to the advantages referred to above, renders the stability of the car more certain than that in which this arrangement is reversed.

The wheels are fitted with pneumatic tires of a novel design, of which we hope to be able to give further particulars in a future issue, and these, together with the spring cushion seats with which the car is provided, form an exceedingly comfortable and serviceable vehicle for which there should be a very large demand.

To start the car all that is necessary is to give a few revolutions of the pedals, when the first explosion will almost immediately take place, and the motor will continue to run automatically. There being no tubes to heat or batteries to attend to, the car is always ready for immediate use, and will run so long as there is any petrol remaining in the tank.

The speed is adjustable from about four to sixteen miles per hour, and the car is sufficiently powerful to carry two persons up all ordinary gradients, but when required for hilly districts a second speed is fitted, enabling the machine to climb practically any hill.

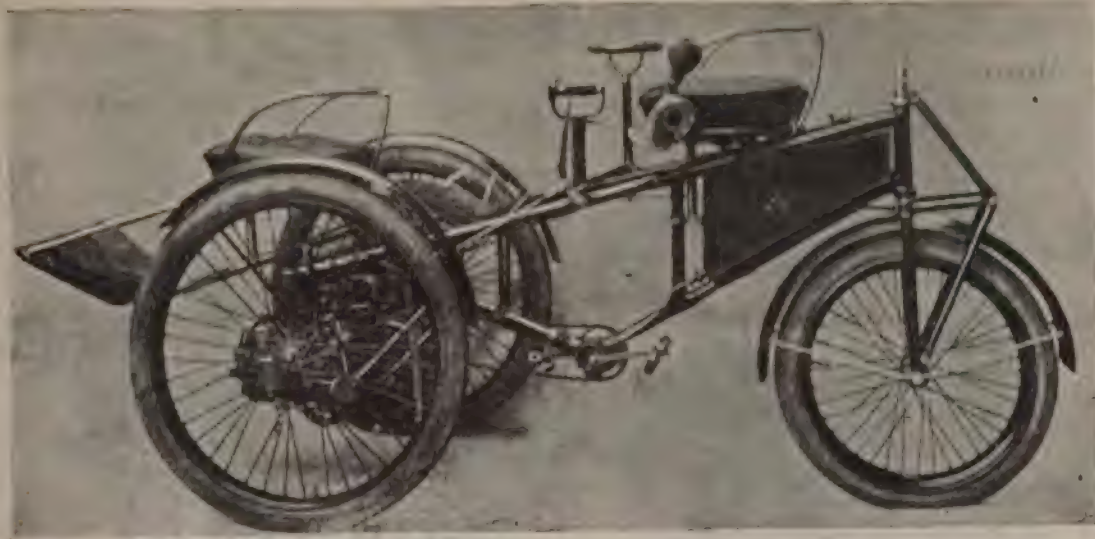
Koch Kerosene Carriage.

The Koch kerosene carriages, made by the Société des Automobiles Koch, Paris, are said to be practically orderless, owing to the use of an ingenious vaporizer. The oil as it comes from the supply tank is first heated, and then sprayed and mixed with hot air in the explosion chamber. It is here exposed to an incandescent tube having a relatively large incandescent surface, the result being that very perfect combustion takes place, and the exhaust consists almost entirely of completely burnt gases. The advantages of using kerosene in motor vehicles are great. Oil is much cheaper, more easily obtainable and less liable to casual ignition from careless or unskillful handling. The motor is of the horizontal single cylinder and double piston type with rocking arms. Its maximum power is six B.H.P. Three speeds are provided by the mechanism, four and a half, twelve and eighteen miles per hour. The vehicle is of a very substantial character and can comfortably accommodate six persons.

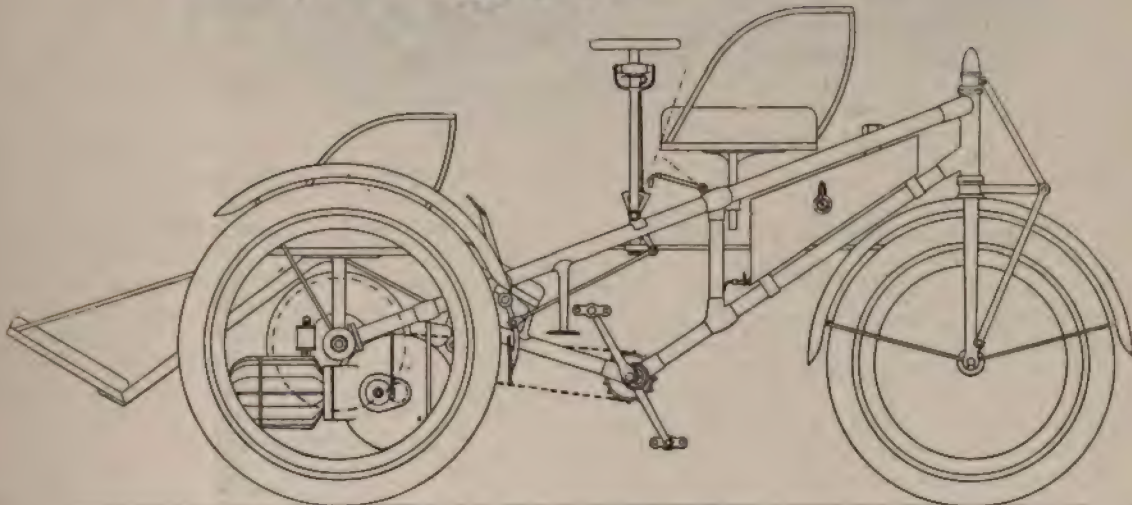
The "Never Content."

Such is the curious name given by M. Jenatzy to the electric racing machine with which he is endeavoring to break the kilometre record now held by Count Chasseloup Laubat.

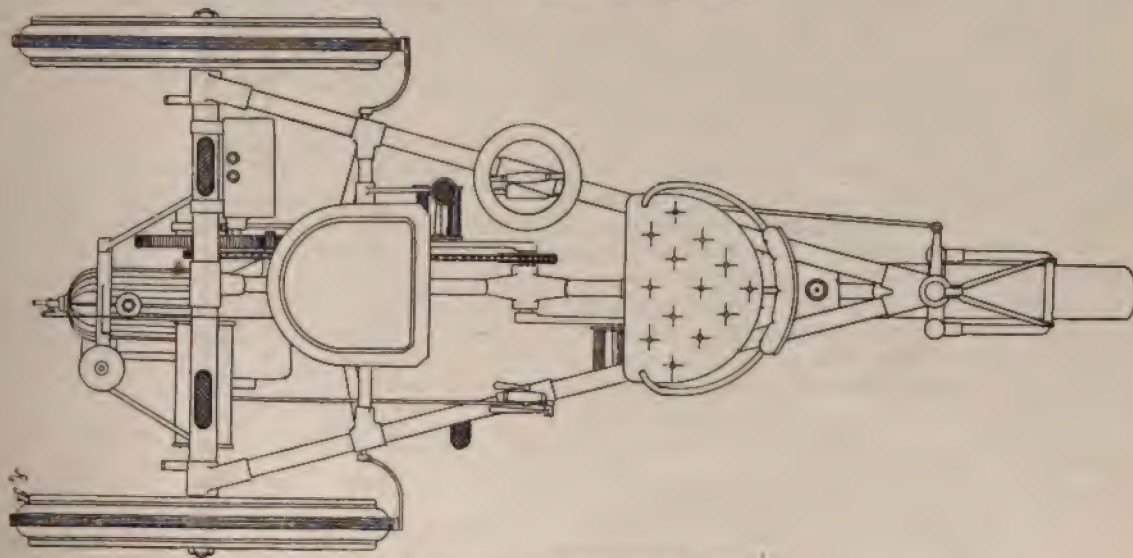
The body of the vehicle resembles a submarine torpedo boat. The top is wholly cased in, save for an opening in which the conductor sits, the idea being, of course, to minimize air resistance. The body is carried on a frame which, again, is supported by specially designed springs from the axles. The storage cells of the Fulmen type are arranged in the body so as to give the greatest amount of adhesion to the wheels. A peculiarity is that the motor is coupled direct to the driving (rear) wheels without the intervention of any intermediate gearing. This, of course, necessitates the employment of small sized driving wheels. These are of very solid construction and are pneumatic tired. The total weight of the vehicle is 2,200 pounds. In some trials held recently for the kilometre record at Achères, the best time made by this machine was 1,200 kiloms. in 46 s. = one mile in 61.8 s.



SIMMS' MOTOR WHEEL.



ELEVATION OF THE SIMMS MOTOR WHEEL.



PLAN OF THE SIMMS MOTOR WHEEL.



THE "NEVER CONTENT" OF M. JENATZY.

The Serpollet Steam Omnibus.

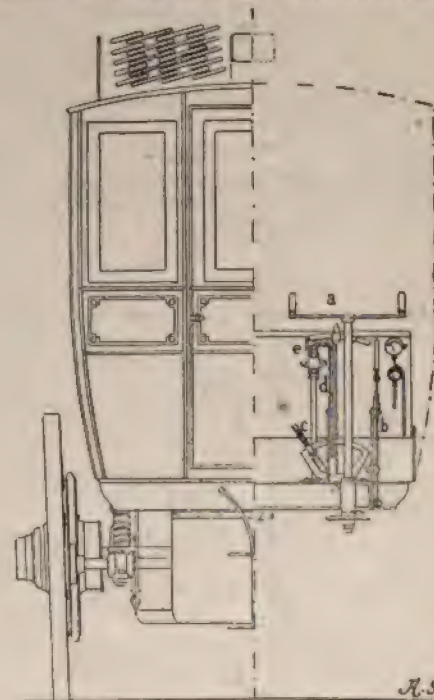
This vehicle is built to accommodate fourteen passengers, twelve inside and two on the front platform, and also 1,100 pounds of baggage on the roof, the entire load being estimated at about 3,080 pounds. Fig. 1 is a general view of the vehicle. The generator, of the well-known Serpollet type, is placed just over the front truck. The heating surface is 75.86 square feet, and the total weight is 2,750 pounds.

The fuel is kerosene, carried in a tank, *h* (Figs. 2 and 3) situated below the floor of the vehicle. In Fig. 1 this tank is seen immediately under the floor at the extreme end of the vehicle. The capacity of the tank is 330 pounds or about forty-one gallons. By means of a hand pump the oil is subjected to a slight air pressure which forces it to the burners. The air pressure is regulated by a special pump, worked when the motor is running, so that the amount of kerosene delivered is proportioned to the steam to be generated.

The burners heat the generator to a temperature of between 660° F. and 750° F. in about forty-five minutes. About one and one-half pints of water, injected by a hand pump, is immediately "flashed" into steam. The further supply of water is pumped into the generator by the small feed pump *i* (see Fig. 3). The supply of kerosene to the burners, and of water to the generator, is so regulated as to maintain the steam at a pressure of 213 pounds to the square inch and a temperature of about 660° F., having about 300° F. of super heat.

The combustion of one pound of kerosene produces 13.7 pounds of steam at this temperature and a pressure of one atmosphere in the kerosene tank forces from twenty-six to thirty pints of kerosene per hour to the burners, the combustion of which produces about 440 pounds of steam per hour.

The consumption of steam at the temperature and pressure stated, and with a cut-off of about thirty-five per cent., is about twenty-six pounds per H.P., the total power of the motor being seventeen H.P. (127.5 dynys, or 12.75 kilowatts). This power can, however, be doubled on occasion; thus, at the late Versailles trials, while ascending a gradient of 7.7 per cent. for a length of 981 yards at a speed of between



SERPOLLET OMNIBUS (Half Transverse Elevation)

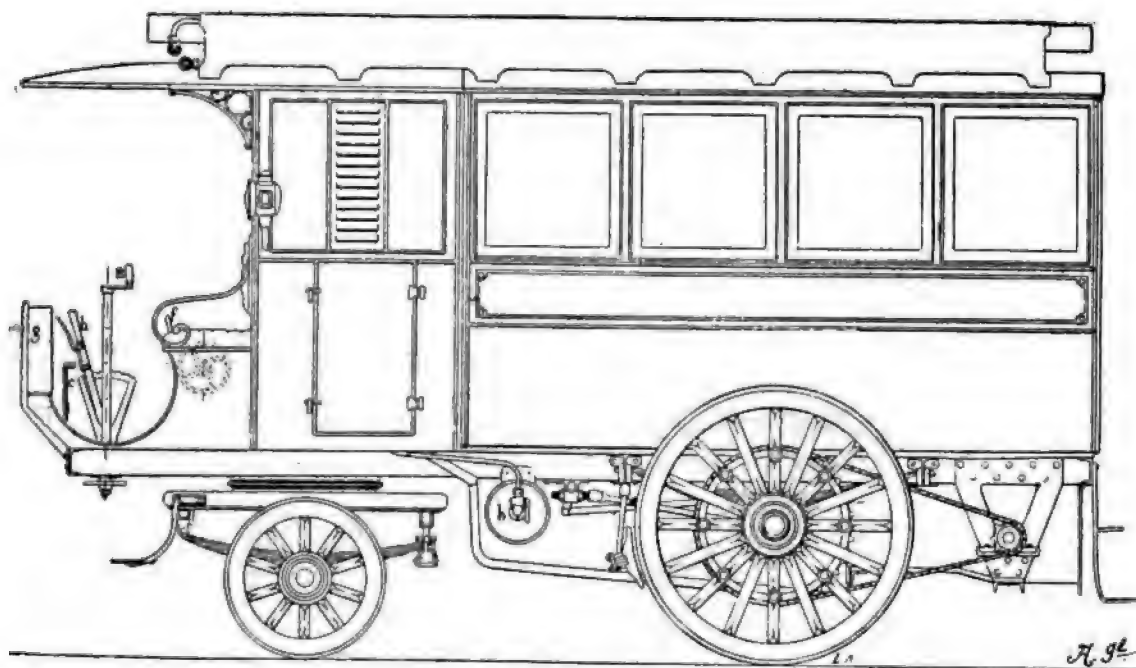


FIG. 2.—SERPOLLET OMNIBUS (Elevation).

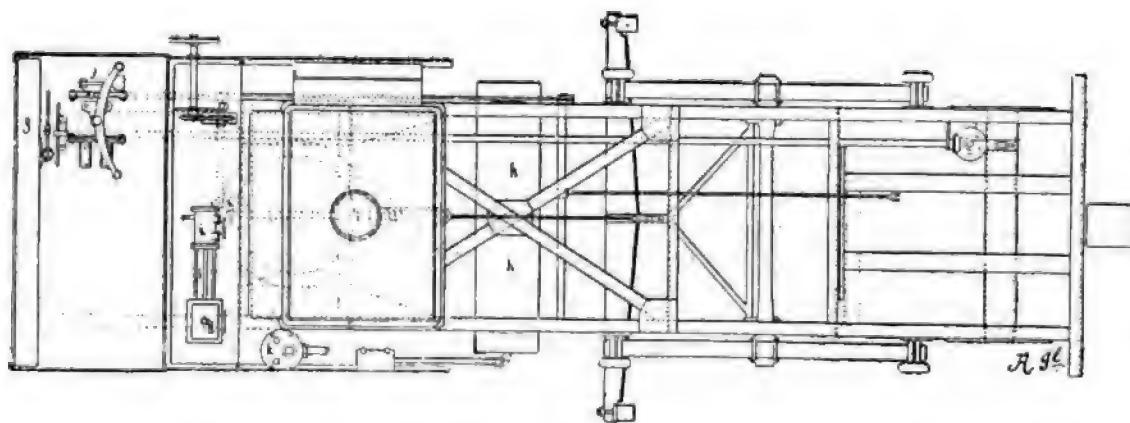


FIG. 3.—SERPOLLET OMNIBUS (Plan).

6.8 and 7.4 miles per hour, the motor developed as much as thirty-one H.P. at the driving wheels.

The motor is of the Serpollet type, which has been previously described by us. In the present vehicle there are two cylinders, 4.724 inches diameter and 3.937 inches stroke. They work at simple expansion, and drive two cranks placed ninety degrees apart. Upon the main shaft are two pinions, either of which can gear with the pinions on the differential gear, the

ratios between the two being $\frac{1}{1.24}$ and $\frac{1}{1.88}$ respectively. The

motion of the differential shaft is transmitted by chain and gearing to the driving wheels, the reduction being five to one, quick stoppages ample brake power is provided, the driving wheels being 6.2 and 9.4, according to the gear in use. According to the nature of the road and the speed desired the motor speed varies from 415 to 625 revolutions per minute.

On the roof of the vehicle is a condenser cooled by the air, but provision is made to carry an ample supply of water, in case the latter does not operate well. The condenser, however, in general permits a much less quantity of water to be carried. Referring to the drawings, f is a hand feed pump, l is the balanced valve for regulating the pressure in the generator, d is the steam regulator, b is the change gear lever, and c is the lever for changing the speed; a is the steering bar or tiller, which actuates a mechanism consisting of pinions and chains attached to the fore carriage. In order to ensure quick stoppages ample brake power is provided, the driving wheels being fitted with Lemoine brakes and also with ordinary brake blocks, while, of course, by reversing the motor extra command over the wheels is obtained. The other features of this vehicle are apparent from the drawings and need no description.

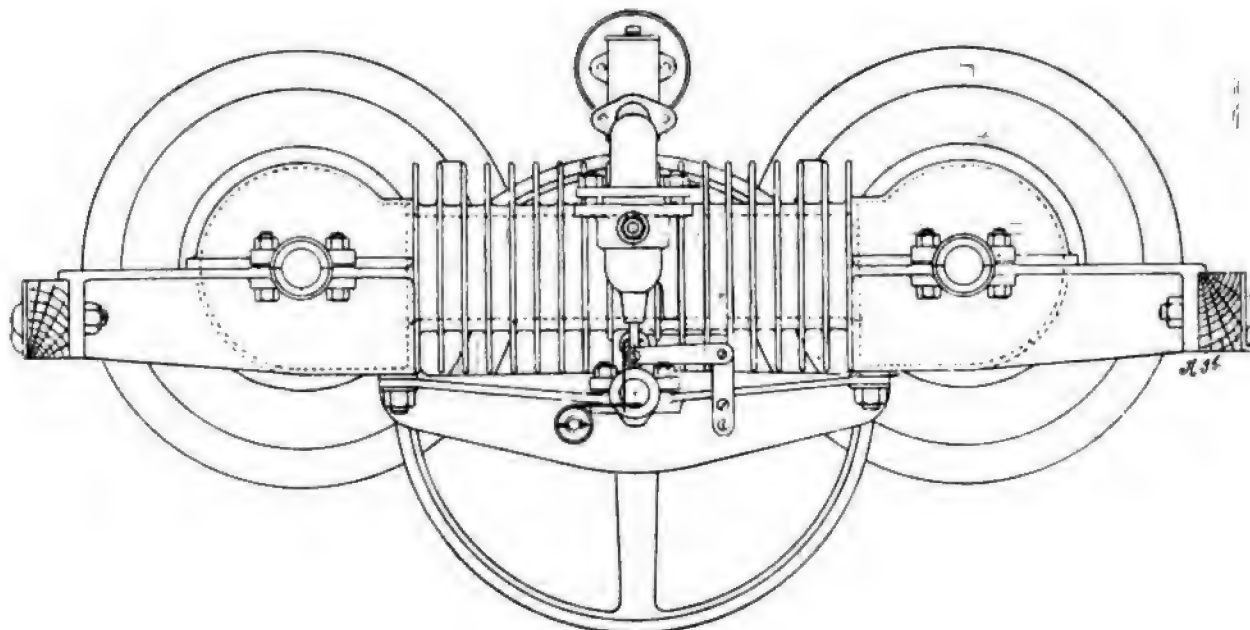


FIG. 1A.—ELEVATION OF THE HYLER-WHITE MOTOR.

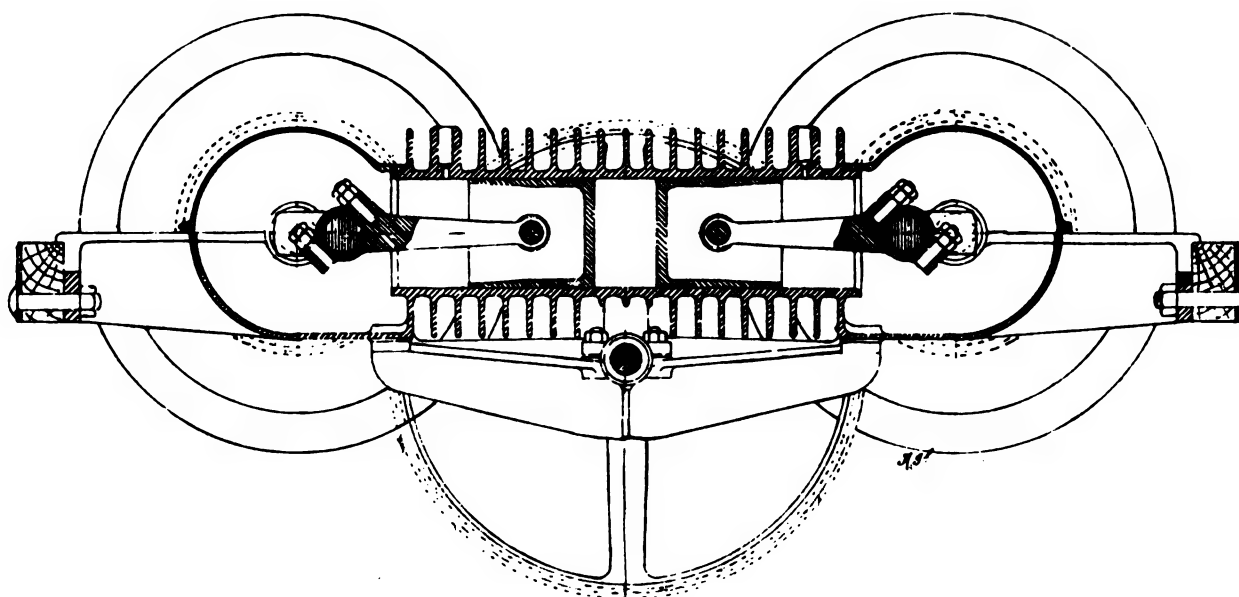


FIG. 2.—SECTIONAL ELEVATION OF THE HYLER-WHITE MOTOR.

The Hyler-White Motor.

This motor, which we illustrate herewith, is from the designs of Mr. F. C. Nunn, A. M. I. C. E., and Mr. T. Hyler-White, of Coventry. As will be seen from Figs. 1, 1a, 2 and 3, it consists of a single horizontal cylinder, in which reciprocate two pistons, coupled by piston rods to two cranks, one at each end of the cylinder; on each crank-shaft is keyed a pinion which engages with a larger pinion on the main shaft situated below the cylinder. The motor illustrated has a cylinder three and one-half inches in diameter, the stroke being three inches. It works on the Otto cycle. Petroleum

spirit is fed under slight air pressure to the carbureter (see Fig. 4), in which is a small needle valve worked by a cam on the main shaft. By means of gauze baffle plates the petrol is broken up and intimately mixed with the necessary quantity of air, the mixture passing into the combustion chamber between the two pistons and ignited and exploded in the usual way. In the present motor tube ignition is employed, but the design is being modified, so as to permit either tube or electric ignition. Governing is effected by holding the exhaust valve open. The normal speed of the motor is 800 revolutions per minute, when it develops three H.P. For small powers, as in the present case, the cylinders are made with radiating gills, but in the larger ones water jackets are fitted.

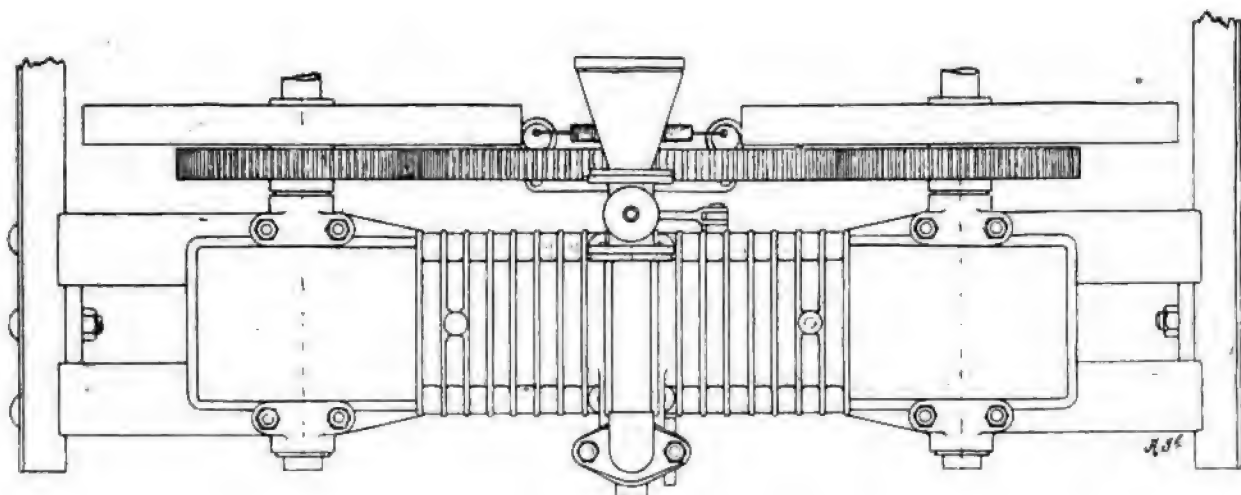


FIG. 3.—THE HYLER-WHITE MOTOR (Plan).

As fitted to a vehicle the motor is placed with its cylinders transversely, the distance between the side frames being thirty-six inches. The total weight of motor, with fly-wheels, is 125 pounds. The pinions are made of raw hide, and run with little or no noise. We understand that tests made with the motor have been of a very satisfactory nature. It is manufactured by Messrs. John Smith & Co., Grove Iron Works, Carshalton.—*Automotor*.

Braking on Rubber Tires.

Says a correspondent of the *Automotor* in reference to the fatality at Harrow:

"The construction of the wheels is quite sufficient to condemn them (in the mind of a competent man) without requiring an accident to endorse the condemnation. I have long since been expecting to hear of such accidents. Naked india rubber tires, whether solid or pneumatic, are not proper ones to be applied to the driving wheels of any self-propelled vehicle, but, on the contrary, they are particularly dangerous appendages, even if the brake is applied elsewhere, but when the brake is applied to the circumference of such tires then the risk of having a serious accident is vastly increased. To apply a brake to the circumference of such tires is the most absurd thing any moto-car maker can do. To say the least, the outer circumference of a driving wheel should be rigid (not elastic), no matter whether the brake be applied there or not. In the case of wheels with wood naves, I consider that they are dangerous, as they often crack and bushes become loose; furthermore, such naves are nearly cut to pieces by the wheelwright, by making recesses in which to drive the spokes. Wood felloes are also much weakened by the holes where the spokes enter, so I condemn them along with the wood naves. I notice that some makers of moto-cars are constructing wheels with wire spokes, arranged in a slightly tangential manner, but I fear that this arrangement will also soon be found to be insufficient to withstand the heavy torsive strain which will be put upon them."

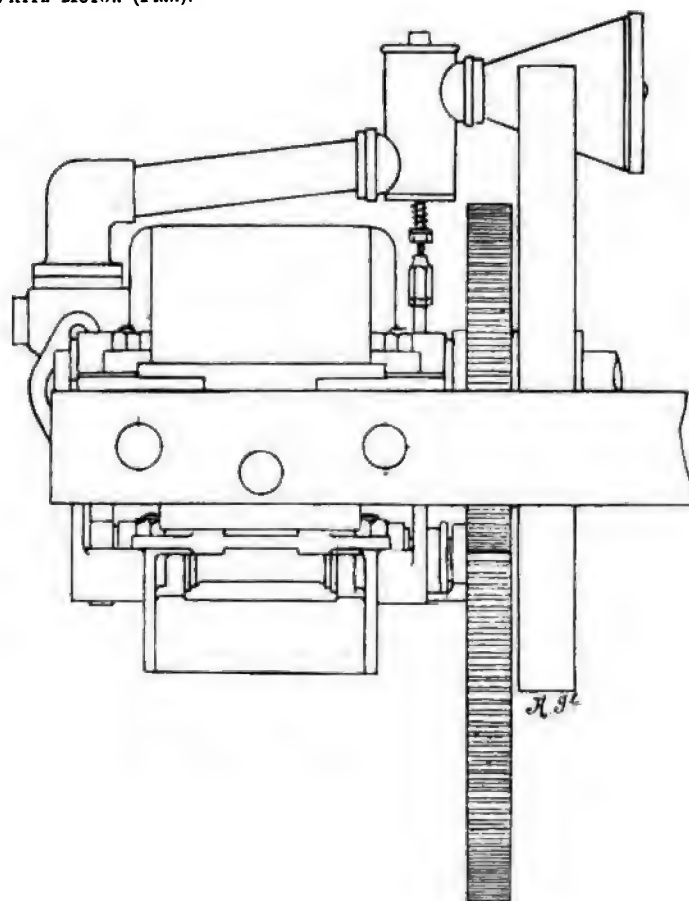


FIG. 4.—THE HYLER-WHITE MOTOR (Transverse Elevation).

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of *THE HORSELESS AGE*, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

LONDON NOTES.

One of the drawbacks to the hand-wheel steering gear, which has become so popular in France, is that when the front wheels, owing to the meeting of an obstruction, or to inequalities of the road traversed, have a tendency to be jerked out of their designed course, this movement is transmitted to the steering hand wheel and to the hands of the driver. To overcome this difficulty, M. Jeantaud, of rue de Pontieu 51, Paris, the well known builder of electric motor carriages, has generally devised what he terms an "irreversible" wheel steering device, or a steering gear so contrived that while the front wheels respond to the action of the steering hand wheel, the former cannot inversely transmit any movement to the hand wheel. This is effected by a special contrivance fixed in a circular box under the hand wheel in the steering pillar. The hand wheel is mounted loosely on the steering standard, the connection being made through two spring bands inside the box acting on a special piece keyed on the vertical steering standard. Steering is effected in the usual way, while the springs, which are faced in leather, are so arranged that when the front wheels are jolted out of their proper course, springs are jammed onto the walls of the circular box, not only preventing any action on the steering hand wheel, but also preventing any serious deviation of the front wheels from their intended course.

There is every indication that the British postal authorities are fully alive to the fact that in motor vehicles there is promise of something which will sooner or later supersede the horse drawn vehicles, not only those used in towns, but also those employed for night service between London and Brighton and other towns. The authorities, however, have not yet made up their minds as to the most suitable type of vehicle, nor as to the motive power best suited to the purpose. They have already given steam and electricity a trial, while, now, during the past fortnight a trio of petroleum motor vans of a glaring red color and with letters "V. R." have made their appearance on the London streets. The vans are the largest petroleum vehicles that have so far been constructed in England, being intended to carry a load of about 3,000 pounds. Inquiries elicited the fact that the postal authorities have not purchased these vans outright, but have leased them from the Daimler Motor Co., Ltd., of Coventry. The vans have a floor space of 9 x 5 ft., with a height of 6 ft. The motor is a four cylinder Daimler, capable of working up to eleven actual H.P. It is arranged under the driver's seat, being a departure from the usual practice of the Daimler Co. Special provision is made for the covering of the cylinders, while an improved form of hand wheel steering is provided. The weight of the van, complete, is stated to be a little over two tons. Should the experiments prove successful, the postal authorities contemplate introducing motor vans on a larger scale.

The familiar vehicles of the London Electrical Cab Co., Ltd., have been missing from the streets of the metropolis for some weeks past, owing to considerable alteration in the accumulator charging arrangements at the company's depot in Lambeth. The company has now installed an extensive plant of 500 H.P. for charging the accumulators, so that this work can be done continuously day and night, if desired, instead of only for a few hours in the night, as hitherto. In the interval advantage has been taken to overhaul and redecorate the cabs, many of which have been in constant service for nearly two years. It is said the service will be renewed on an increased scale on May 1.

Motor Vehicle Design, Some General Notes.

By R. I. CLEGG.

Of the many plans for motor vehicle construction that have come my way I fail to remember even one that was not more or less influenced by the horse-drawn vehicle. This is natural, since the experience gathered from long acquaintance with the coach builder's art, as well as familiarity with the horse and his burden, gave the impression that a horseless vehicle was simply minus the horse. Following this line of thought, most designers struggle to make the self-propelled carriage as innocent of machinery and as short as though a horse were to be attached at any time. I can account in no other way for the fear shown by some horses at the approach of a motor vehicle; it is, to them, the very evident lack of something quite essential to the orthodox wagon.

Of course, if a motor vehicle is to be built simply as an experiment to demonstrate the capabilities of some untried motor, and if funds are lacking for a thorough combination of the motive power and the carriage, then there is little choice and the designer casts about for a carriage already in the market that will bear the weight he proposes to add; or, failing in that, to get such supplies from the dealers in carriage hardware as will permit him, with a minimum of expense, to put his venture to the test. Unfortunately the ease with which one may do this, starts the designer in a groove from whence he does not escape, and taking a catalogue of some coach builder as a guide, he selects a body, makes a tracing of the outlines and transfers his motor thereto. Should he find that he cannot get all the machinery within the limits he lowers the floor and extends the box of the body upward and backward. A drawing of this kind has been submitted to me within the past few weeks. It was of a rather high two-seated carriage; under the one seat was the boiler and under the other was the engine. The carriage was a stock affair and no conception of the motor vehicle had in all probability ever entered the mind of the builder. The dashboard was exceptionally high—perhaps a little carelessness on the part of the draftsman in copying may account for this. I have always considered the dashboard, most of all, a protection against the filth and dust created by the horse. Remove the offending source and the need of a guard lessens. To be sure motor carriages may raise mud or sand, etc., ahead of you on the road, but this trouble is not of so much importance as the one just mentioned.

Should a company decide to apply a compact power unit to wagons already in use, say the wagons of the large express companies—and this is a most promising field—then the designer must make the best of the situation and tie his Pegasus to the truck as necessity shall require.

When the machinery is concealed from the spectator on the curbstone it is generally equally out of sight of the driver, who should be able to cast a watchful eye upon the motor now and then, however trustworthy it may prove. Let us suppose that some slight mishap occurs, such as might be the lot of a bicyclist; how easy if the machine is in plain sight to get at and fix the trouble just as you would an ordinary wheel. I remember a motor vehicle on a country trip exhibited symptoms of something being loose about the engine crank, and the owner got down on his back (the engine being near the ground), removed the crank case, and managed to empty the contents (crank case oil) over his clothes.

The point is sometimes raised that the motive power is enclosed to protect the machinery. As a rule the power outfit is not wholly protected, the under side being frequently open, hence this statement appears to have little weight.

I take it for granted that the sight of nicely proportioned metal work is pleasing to the eye, and that there can be no æsthetic objection to seeing the engine or motor. Again, the motors adopted are self-contained, the engines having a crank case and the electric motors being iron-clad, so that dirty oil is not thrown off to ruin clothes any more than weather or road conditions can damage them; in short, if the engines are visible, there need be nothing offensive.

There would be an advantage in having an explosive engine where the air could freely circulate about the cylinder, and the cooling effect of the circulating water or of the heat radiating flanges would be greatly increased.

Out of the many owners of steam yachts I have met, not one but exhibited with pride the propelling plant, and there is in the motor vehicle nothing of a permanent type that cannot be brought to the light with equal satisfaction. The cylinders, boiler, etc., can be lagged with mahogany, bound with nickel or aluminum strips, and the metal base nicely enamelled in bicycle finish.

There is another consideration; bringing the machinery to plain view would mean neat and simple designs. The omnipresent sidewalk critic would soon point out the real blemishes, and the efforts to have smooth running, natty appearing mechanism could not but have a highly beneficial tendency upon motor vehicle design.

The horse-drawn equipage must have considerable length over all and therefore the carriage is shortened as far as practicable, bringing the axles close, and unless guards are used, making it difficult to step into or out of the vehicle without soiling the clothes. When the motor vehicle designer slavishly copies the horse-drawn carriage, he borrows the troubles inherent thereto. Certainly the shorter his wheel base the smaller the circle in which his carriage can turn, other things being equal, but he can afford to place his forward wheels further ahead, since his facilities for manoeuvring are much superior. Between the wheels ample provision can then be provided for entrance or egress.

Should the motor be placed ahead of the carriage, then the shaft can be connected to the driving wheels by bevel gears, or chain, running aft to the compensating gear. The connecting shaft passing beneath the driver would afford a good opportunity for connection of speed changing devices without the usual lengthy complicated linkage to operate the same.

The designer who has to adapt the body to the running gear may, with advantage, use a kink in vogue by some machine tool draftsmen, who have a jointed model of the human frame, made of cardboard or sheet metal to some determined scale, which can be laid upon the drawing and the limits of the action of the limbs in moving handles or foot levers easily ascertained. In the case of a foot brake such a model is of great value, since it is easily understood that the leg acts precisely as a toggle joint, and starting from a completely flexed position to the full extension of the limb the effective thrust gradually reaches its maximum, until as the leg becomes straight the sign changes. The model, therefore, serves to obtain the best position for the brake relative to the height of the seat, etc. The brake lever is often pivoted some distance below the flooring, so that the arc traversed may be as long as possible. If sufficient leverage can be obtained near the point of application of the brake to the wheel,

then the foot plate may be inserted in a metal slide in the bottom of the carriage body.

It is to be noted that, if the foot brake is placed where the operator can get the full force of his advantage in position, the brake lever must be proportioned to stand the corresponding strain. The maximum pressure on foot levers is usually assigned as 180 pounds (see Unwin Machine design p. 387), though much less than this is allowed in bicycle calculations. As the brake is an emergency feature, however, economy in weight might be dearly bought.

There is a tendency toward dependence upon the tires for easy riding rather than upon springs interposed between the body and the running gear. In part this is the effect of a desire for a simpler connection between the two, and this hope is feasible, as shown by some of the light steam vehicles described in these columns. When, however, this plan is tried simply to use the body as a bed or frame on which to attach the motive power, then the results are not conducive to easy riding, and the discomfort increases with the weight of the carriage. Anyone may test this by blocking the springs under a bicycle saddle. If the machinery is bolted to the body, suitable guides are necessary to preserve the distance and alignment of the transmission devices, assuming that there is any attempt to introduce springs between the frame and body. These guides are arranged vertically and hence the shocks due to the meeting of the wheels with obstructions or inequalities in the road are transmitted through the slides as well as through the springs, the latter thus being only partially effective.

The lighter the body, the greater its range of movement, the greater the resilience of the supporting springs, and the greater the arcs of action over which the sharp reactions of the wheels on uneven roads are distributed. If, in addition, the motor is severed from all connection with the body then another source of vibration is removed.

The "Wing" Solid Vehicle Tire.

The Goodyear Tire & Rubber Co., Akron, O., are putting on the market a new solid vehicle tire called the "wing" because of the shape of it. The tire is molded with stiff rubber wings extending outwardly, which when pressed in the channel, expand against the metal flanges at all times, thus preventing the entrance of dirt and water. By the insertion of the wing between the channel and the main body of the rubber tire the channel may be filled tighter with rubber without running any risk of cutting on the edge, which is said to prevent creeping. The manufacturers furnish a tire machine for applying the rubber direct to the channel.

Quality of Rubber.

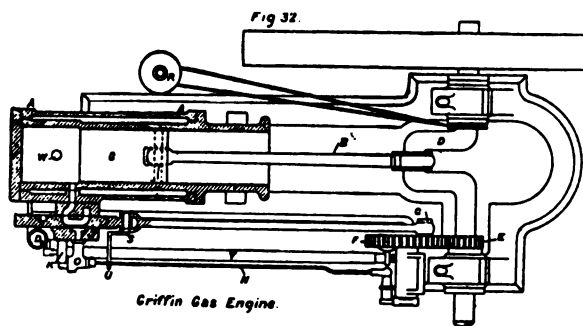
The Newton Rubber Works Co., Newton Upper Falls, Mass., lay great stress upon the quality of the rubber used in their motor vehicle tires. They are very closely connected with the largest importers of crude rubber in the United States, and hence have exceptional facilities for obtaining the best and exceptional skill in selecting the best. Those who have experimented much with motor pneumatics know how important this matter of quality of the rubber is to the life and resiliency of the tire.

The Cycles of Gas and Oil Engines.

BY MR. JAMES D. ROOTS.

No. IX.

Griffin's patent, No. 4080, August 23, 1883, has been selected as the first representative of this cycle of three revolutions, type 8 in the chart, because it is the most widely known three-revolution engine. Fig. 32 is a horizontal section produced by combining two of the drawings in Griffin's patent, including those parts necessary to explain the cycle. It is single acting; many of the Griffin engines subsequently manufactured were double acting. A is the cylinder, open at the front end. B is the connecting rod which communicates motion from the piston C to the crank D. On the crank shaft is fitted the toothed wheel E, which gears with the toothed wheel F. The large wheel F being three times the diameter, and having three times the number of teeth of the smaller wheel E, it follows that F will rotate once for every three revolutions of the crank shaft. In the wheel F is fitted a crank pin G, which gives motion by means of the rod H to the slide valve I. There are cams driven by the wheel F for operating the exhaust valve and gas valve. W is the port leading to the exhaust valve—an ordinary mushroom valve opened by a lever and cam.



With the piston C in the position shown at the back end of the cylinder, and the inner end of its stroke, the exhaust valve has just closed, the slide I is just opening to admit air to the cylinder. During the first out stroke of the piston air only is drawn into the cylinder through the slide I. This is shown in the diagram Fig. 33 from A to B. At the end of the stroke the exhaust valve opens, and during the instroke from B to C the charge of air is displaced from the cylinder, sweeping with it the products of combustion remaining in the cylinder

from the previous combustion. On the next out stroke from C to D on the diagram (Fig. 33) the working charge is drawn into the cylinder for the whole stroke. During the next in stroke from D to E the charge is compressed, and at the dead point F, commencing the third revolution and cycle, or a little after, is fired, propelling the piston outward on its working stroke from F to G; at G the exhaust valve is opened, retained open until the end of the working stroke, and also during the next instroke and last stroke of the cycle, while the products of combustion are being displaced through the exhaust port from G to H, when the cycle commences again at A.

I have given in this description the cycle (Fig. 33) as employed in the engine as subsequently manufactured; but the inventor includes in this patent the drawing in the charge for a portion of the first out stroke of the cycle, from A to B. Such a modification of the cycle would certainly be a disadvantage, as there would be considerable difficulty with such an arrangement in preventing a portion of the new charge from passing through the exhaust valve during the next instroke from B to C.

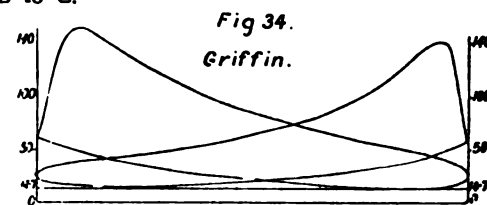
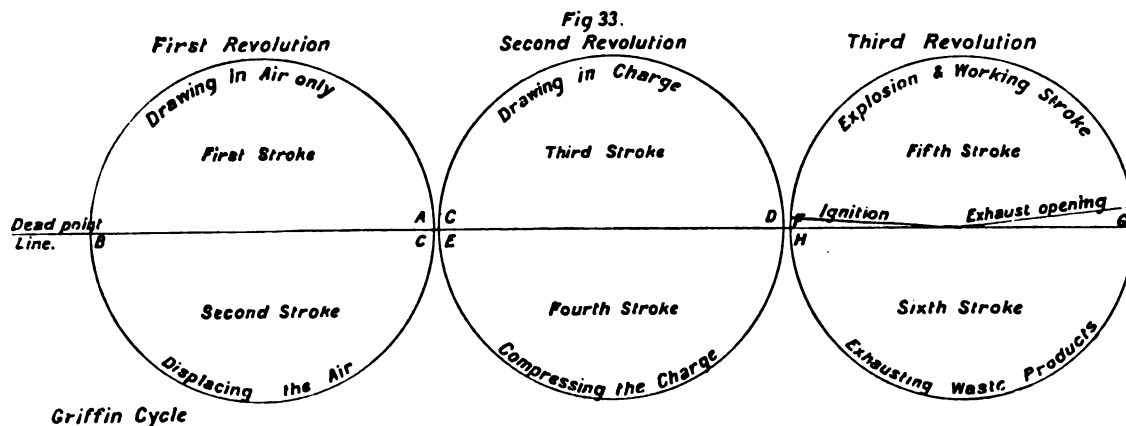


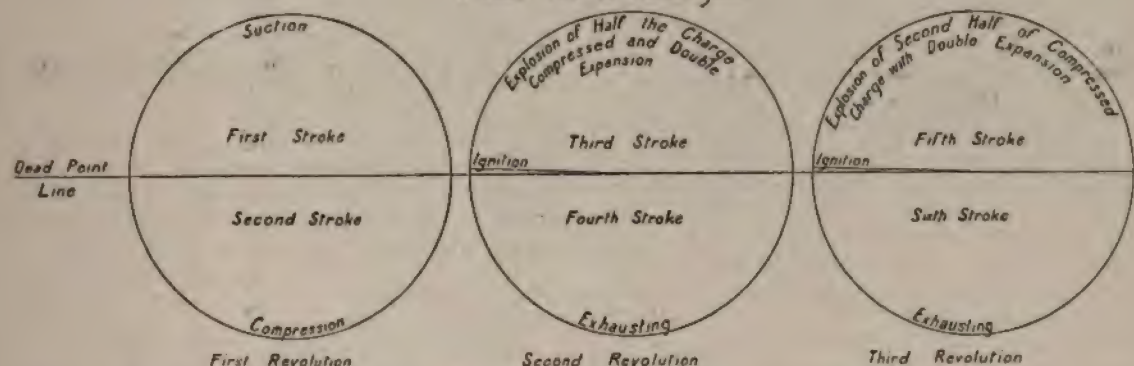
Fig. 34 is an indicator card, or rather cards, taken during the Society of Arts' trials from the Griffin engine. It was a double acting engine; that is, the complete cycle was carried out, and explosions took place on both sides of the working piston. So far as the cycle is concerned, it is only necessary to consider the card taken from the back end of the working cylinder, as the operations on both sides of the piston were precisely alike. The difference, however, between the areas of the two diagrams is instructive, as showing the effect of a small additional cooling surface, exposed to the working charge during combustion. In this case the reduction of pressures is stated to be chiefly due to the piston rod passing through the front combustion space, and no doubt is partly so, although I cannot help thinking that there must have been some other occult cause to produce so great a difference in the mean pressures shown, viz., 61.5 pounds per square inch in the back of the cylinder and 47.5 in the front. Possibly the back was in some way getting more gas than the front.



This cycle was probably originally devised to evade the Otto patent, which had been upheld by the courts, as we now know, more or less wrongly, as the de Rochas patent anticipated the Otto cycle a good many years previously. When the Otto engine became so pronounced a success, strenuous endeavors were made by inventors to discover some new cycle, or to devise some addition to the existing Otto cycle, which would enable a gas engine to be put on the market to compete with it. The inventor of this three-revolution cycle

three of the crank shaft. E is the inlet valve to the chamber C, which valve also covers when closed the gas ports E1 in the valve seating, supplied by the gas pipe E2.* F the port to the exhaust valve for the last or complete exhausting stroke, opened by a lever and cam on the rotating side shaft. G is the exhaust valve for the first working stroke of the cycle; it is operated by a lever from the rotating side shaft. The tappet end G1 of the lever is shown. This second exhaust valve was not absolutely necessary, and might have been avoided.

Fig. 35.
Roots Two in Three Cycle



was C. Linford, whose name stands first on the list of this type 8, class 2 (see table) and some of the Linford patents display marvelous ingenuity and fertile inventiveness.

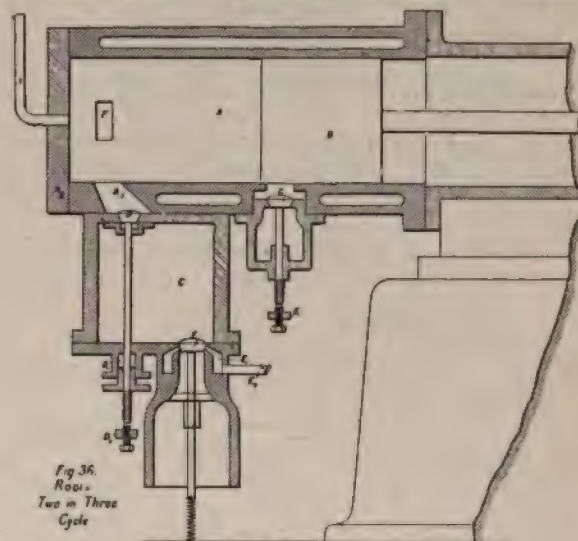
The patent 330 of 1880 contains no less than twenty-seven figures, all of which are well thought out and thoroughly studied designs. I do not mean by this that they would be necessarily successful in practice.

There are, however, two engines which I know of still at work in London, and one is giving full satisfaction to its owner, constructed according to Fig. 3 of the before-mentioned patent 330 of 1880; one of them has had tube ignition fitted. The student of internal combustion engines would do well to study the Linford patents.

The next representative of Type 8 is the engine described in my patent specification, 16,220, November 9, 1888, "Improvements in Gas Engines." The diagram, Fig. 35, shows the operations of this cycle. There are three revolutions or six strokes to complete the cycle, of which there are two working strokes and one full or complete stroke each of suction and compression. The cycle consists of first stroke (out stroke), a complete suction stroke; second stroke (instroke), complete compression stroke; third stroke (out stroke), ignition of half the charge previously compressed and working stroke with expansion to double the volume the charge occupied before compression; fourth stroke (instroke), exhaust for a part of the stroke and then admission of the other half charge to the cylinder from the chamber and compressing it again; fifth stroke (out stroke), ignition of the second half of the charge, working stroke, and expansion to double volume; sixth stroke (instroke), a full exhaust stroke. Referring to Fig. 36, which is largely a diagrammatic section of a portion of the engine to show the cycle, A is the cylinder, B the piston, C the chamber for receiving half the charge drawn into the cylinder; A1 the cylinder inlet port, A2 the cover, D the valve closing communication between the chamber and the cylinder, D1 the gland through which the spindle of the valve D passes, D2 the tappet of the lever operated by a cam upon the side or valve shaft. The side shaft—not shown—makes one revolution for

I is the ignition tube, kept at a red heat by an ordinary atmospheric burner.

The suction out stroke of the piston B draws in a charge of gas and air through the chamber C by the two valves D and E, the valve D being opened by its lever and cam on the side shaft, the valve E by the atmospheric pressure; at the commencement of the compression instroke the valve E closes, the valve D being kept open by the cam during a part



of the instroke; a portion of the charge is returned to and compressed into the chamber C, as well as in the cylinder and clearance space, the valve D is then permitted to close by the

* It is remarkable how many inventors have had the idea of this method of supplying the gas in an engine; how beautiful and simple it appears as an idea, yet how generally unreliable and troublesome it is in practice, without an additional gas valve to prevent the explosion pressure from occasionally entering the gas supply pipe when the admission valve does not close in time, or is prevented from completely closing by a piece of grit under the seating.

movement of the lever D; and the half charge in the cylinder and clearance space is further compressed, and immediately after the dead point and at the commencement of the third stroke of the cycle is exploded, doing a full working stroke, and having a double expansion, that is, expanded to double the volume the charge ignited occupied before compression, the cubic space of the chamber C bearing a correct proportion to that of the whole cylinder. Close to the working stroke end the exhaust valve G is opened and a part of the exhaust let out. A little after the dead point on the return stroke the valve D opens by its cam and lever or by the pressure within the chamber C, and the half charge then pours into the cylinder, displacing more of the exhaust during the instroke, until the piston has covered the exhaust port of the valve G, which is then closed, and during the remainder of the instroke the second half charge is compressed together with the remaining products. At the commencement of the fifth stroke and the third revolution the second half charge is fired, Fig. 35, performing the second working stroke with double expansion, near the end of which the exhaust valve in the port F is opened by its cam, and the cylinder—except for the very small clearance space allowed—is completely exhausted on the instroke and last stroke of the cycle, when the series of operations commences anew.

No engine upon this cycle was made; the patent has now lapsed, and therefore the cycle is open for anyone to use. Its advantages, viz., two working strokes in three revolutions, in each working stroke the charge is expanded to double its volume when at atmospheric pressure, as compared with one working stroke in two revolutions in the de Rochas cycle, expanding to the same volume the charge occupied at atmospheric pressure, are so obvious that I need not further dwell on them. The power used in the process of compression is only slightly greater in this two-in-three cycle than it is in the one-in-two. I am convinced this cycle will be much heard of in the future.

QUESTIONS AND ANSWERS.

At the request of many of our readers we have decided to open a department of questions and answers. We will endeavor to answer any detail question in practical engineering pertaining to motor vehicles.

What's the Best Muffler?

Editor HORSELESS AGE:

Will you kindly inform me of the method of construction of the most satisfactory muffler for a five H.P. gasoline motor used upon a vehicle? Yours truly,

W. O. ANTHONY.

[Such questions as this we cannot answer. We are frequently asked, "What's the best motor?" "What's the best motor carriage?" etc., etc. He who in the present state of the industry especially would undertake to answer such questions is either ignorant of their true import or ignorant of the possibilities of invention in this line. There are a number of very good mufflers, some of which have been described in THE HORSELESS AGE. Probably each inventor thinks his is the best, and is prepared to prove it, and the competition is not closed yet, nor will it ever be. There is no limit to the ingenuity of the human brain. Even as regards the relative merit of mufflers now in use competent engineers would surely differ in their opinions.—EDITOR.]

Answer to T. McNamara, Lowell, Mass.

A timing valve is one that closes off the ignition tube, and is used to regulate the time of explosion in large English engines and not at all in vehicle motors. In this country they leave the open end of the hot tube always exposed to the cylinder, and the timing is done by the size and shape of the tube and the heat of the flame.

Answer to F. H. Adams, Akron, O.

Some large stationary gas engines are started by levers and some vehicle motors, but so far as the editor knows, no marine motors of such small size as you indicate.

The "Fuller" Battery for Sparking.

WORCESTER, May 1, 1899.

Editor HORSELESS AGE:

In your issue of April 26 I see an item on a simple sparking device, i. e., a plunge battery. I think that a "Fuller" battery is better than the plunge spoken of.

Anyone sick and tired of buying special batteries for sparking gas engines will be ready to try almost anything that promises to do the work.

If a plunge battery works all right, owing to its reliability, ease of repair, etc., a "Fuller" would be better still, because it gives a little stronger current than the plunge, is practically without chemical action when the circuit is open, and will lie three or four months, if not used, in good condition, ready for work at any time. It never polarizes and the fluids used can be carried in a small phial or purchased at any drug store. The operator will never forget to lower the elements when he wishes to start, nor to raise them when he stops.

The main difference between the two is that in the "Fuller" the zinc is contained in a porous cup surrounded by water, and the carbon is outside the porous cup in a solution of bichromate of potash, sulphuric acid and water.

Yours truly,

WALTER W. MONROE.

Inquiry from Norway:

CHRISTIANIA, NORWAY, April 15, 1899.

Editor HORSELESS AGE:

DEAR SIR: We shall feel greatly obliged to have the opinion of some leading motor-car manufacturer with regard to the use of motor vehicles during winter time in Norway. Our roads are usually snow covered from November to February and we do not know whether the rubber-tired wheels will work satisfactorily upon the snow-clad ground, but should be happy to enter into correspondence with some authority on this subject. We are somewhat anxious to hear expert opinions, having already made arrangements to introduce a couple of motor omnibusses for passenger (tourist) traffic, and are now negotiating for undertaking motor vehicle service in a couple of our principal towns, and should therefore be pleased to receive proposals from some firms for a vehicle that would be practical for street traffic in our country both summer and winter.

The question of practicability during our winter is also applicable to other types of motor vehicles, such as wagons for heavy goods and delivery wagons.

Yours truly,

O. O. BULL & Co.

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

623,820—Electrically Propelled Road Vehicles—Octave Pautin, Puteaux, France. Filed July 28, 1898. Serial No. 687,145. (No model.)

Fig. 1 is a side view of the electrically propelled road vehicle. Fig. 2 is a corresponding rear view. Fig. 3 is a detail view, partly in section, of the rear axle of the vehicle, on which the dynamo is directly fixed. Fig. 4 represents the devices for changing mechanically the speed. Fig. 5 is a horizontal view of the axle b.

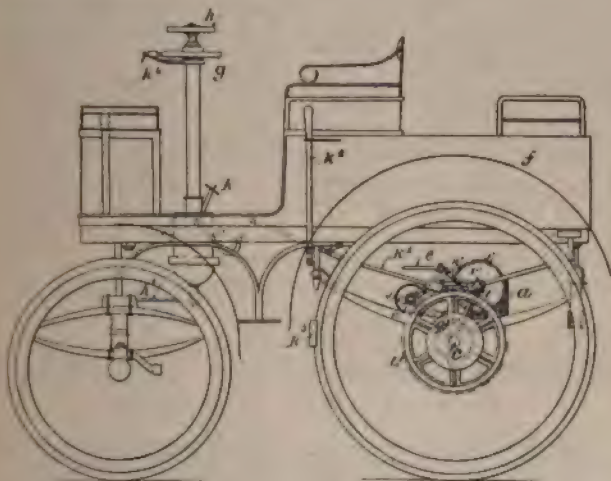
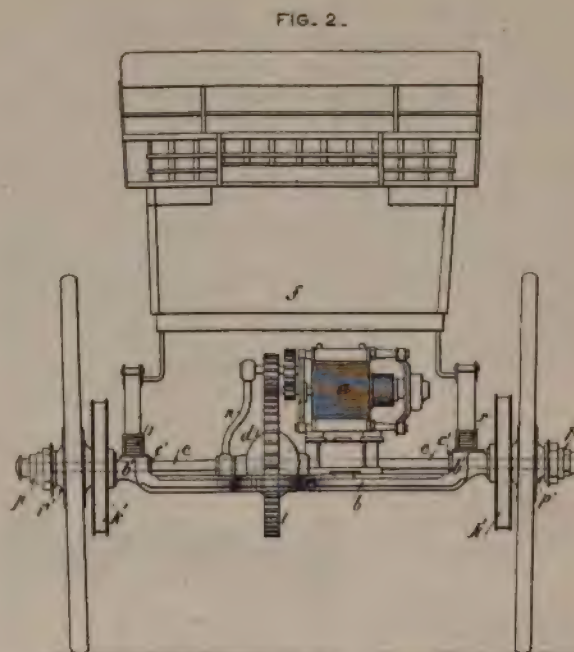


FIG. 1.

Referring to Figs. 1 and 2, showing a vehicle for containing six persons, it will be seen that the dynamo a rests directly on the axle b of the rear wheels. This axle is so arranged as to receive through it the driving shaft c, to which the movement is transmitted by the differential gear d. This differential gear is driven at different velocities either by speed changing gear actuated by a lever e, Fig. 4, adapted to give two velocities, or by changing the speed of the dynamo itself through the medium of different connections of the accumulators contained in a suitable case f, carried by the vehicle, these variations being effected by means of the hand wheel g. The latter can be maintained in a given position by a spring bolt k₄, which engages in notches formed around the periphery thereof. By employing this arrangement there is no risk of suddenly changing the velocity inadvertently. A second hand wheel h, arranged in the same vertical line as the first hand wheel g, controls the steering gear h' through the medium of chains or levers in the ordinary manner. A pedal k enables the brake k' to be actuated, the said brake being an air brake or a band brake operating on the rear axle. A lever k₂ operates a brake block k₃, while the third regulating brake is brought into action by the backward movement of the vehicle con-



trolled by means of the hand wheel arranged in such a manner that the said backward movement can only take place at a predetermined and sufficiently low velocity.

The accumulators employed in the vehicle are of special construction, being very light and of a capacity sufficient to supply current for long distances.

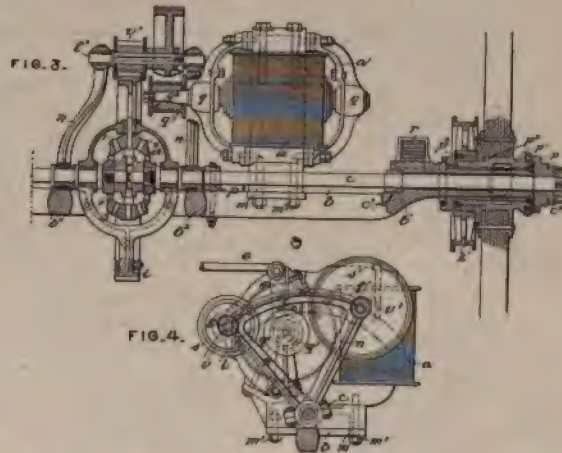


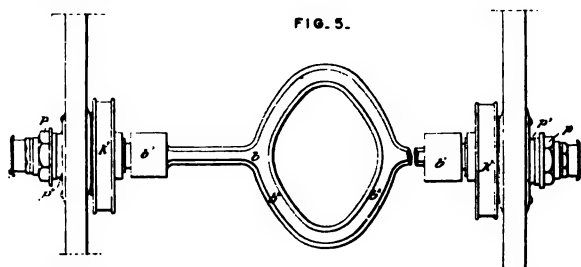
FIG. 4.

The axle is constructed in the following manner: At its middle part b, for a distance extending to the points where the suspension springs are attached, it is curved, so that at this part it is lower than at the ends b', which are made hollow to allow the driving shaft c to pass therethrough. The shaft c is therefore above the body or middle part b of the axle.

In the center of the vehicle the rear axle b is constructed to form a frame b₂, oval in plan, for the purpose of forming a space for the driving spur wheel l of the differential gear d.

The motor a is fixed by bolts upon a plate or flange m, rigidly secured to the axle, the motor being preferably of the kind having two collectors with two coils upon a single inductor. The construction of the motor is as light as possible by the employment, for example, for the construction of the cheeks a', which do not become fatigued, of a light metal, such as alu-

minum. The different devices for transmitting motion and the intermediate gear between the dynamo *a* and the differential gear *d* are supported by the arms *D* of an oscillating support. The driving shaft *c*, which is rotated by the differential gear, passes through the ends of the axle and drives the wheels of the vehicle as follows: It rotates at the inner ends of the tubular parts *b'* of the axle in bronze bearings *c'*, passes through the hollow end without touching the same, being of a less diameter than the holes through the said axle, and by means of nuts *c2* on its outer ends is rigidly secured to locking sleeves *p*, which engage the naves *p2* of the wheels. In this manner it is obvious that as the axle *b* is fixed it rotates at the inside the driving shaft *c* and at the outside the naves *p2* with the wheels.



The wheel of the band or air brake *k'* is keyed on the wheel nave. A suitable number of intermediate bearings *p3* may be arranged on the axle *b* for supporting the driving shaft.

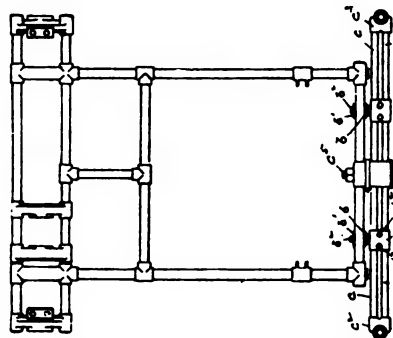
The speed changing gear depends on the application to self propelled vehicles of a principle long known and utilized in workshops. According to this arrangement the driving is effected not by the meshing together of toothed wheels, but by the adhesion of two smooth pulleys, the one the driving pulley and the other the driven pulley, through the medium of one or more leather bands placed between them.

The driving shaft of the motor is supported by bearings *q* in the cheeks *a'* and is provided at its end with a small pulley *q'*, keyed thereto and of sufficient breadth and provided with two flanges *q2*, which form a deep groove in which three or more leather rings can be laid, the said rings being of a diameter larger than that of the pulley which carries them. In this manner when the motor shaft rotates rapidly the leather rings from the effect of centrifugal force turn concentrically with the pulley *q'* and at a certain distance therefrom. In the same plane as the smooth pulley *q'* and arranged so that they can come into contact with it two other smooth pulleys of different diameters *s* and *s'* are provided, the former being of small diameter and the latter of large diameter, the said two pulleys being keyed upon intermediate shafts *t* and *t'*. These shafts are carried by the ends of arms *n n* of the oscillating frame *n n'* mentioned above, and upon each of them is keyed a toothed pinion, which toothed pinions *v v'* may be of equal or unequal size and which are always in gear with the driving spur-wheel *1* of the differential gear. The bevel pinions of the differential gear *1 2 3 4* transmit the motion of the driving shaft *c* in the ordinary manner.

It is obvious that when the motor and the smooth pulley *q'* are rotating, if the actuating lever *e* be moved so as to oscillate the frame *n n'* and if the pulley *s* is brought into contact with the pulley *q'* the leather rings rotate the said pulley *s* by friction, the free portions of the leather rings being applied to a sufficiently large area of the surface of the said pulley *s* to set up considerable friction. The velocity, therefore, of the driving shaft of the dynamo, already reduced in consequence of the relation of the radii of the two above-

mentioned pulleys *q'* and *s*, is transmitted with suitable diminution to the differential gear *d* through the medium of the toothed pinion *v* and of the differential spur-wheel *1*, this speed corresponding to the great velocity of the mechanical change of speed. As the pulley *s'* is of greater diameter, if by an inverse movement of the frame *n n'* this pulley *s'* is brought into contact with the pulley *q* the motion of the latter is transmitted to the wheel *1* of the differential gear by the medium of the pinion *v'* at a still further reduced velocity. Therefore, it is only necessary to oscillate the frame or support *n n'* to immediately vary the velocity when the vehicle is running, without the fear of shocks or of fracturing the teeth of the gear wheels. Furthermore, this arrangement enables the motor to be put into gear when it is rotating idly at its full velocity. To this end it is only necessary to hold the two pulleys *s* and *s'* away from the driving pulley *q'* and to allow the motor to rotate. When the said motor has attained a velocity sufficient to enable it to exert a powerful action, it is connected to one of the pulleys of the frame *n n'*, and a considerable power can be obtained, such as cannot be obtained with toothed speed gears.

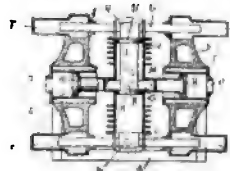
623,651—Fifth Wheel for Electrical Vehicles. Theodore L. Camp, Chicago, Ill., assignor to the American Electric Vehicle Co., same place. Filed June 3, 1898. Serial No. 682,423. (No model.)



Claim.—The combination with the vehicle frame, of a vertically oscillating pivoted axle consisting of a pair of tubes or bars lying side by side in a horizontal plane, a pair of vertical guides or tables carried on the frame on opposite sides of the journal pin of the axle, a pair of brackets mounted on the under sides of said pair of tubes, a clamping plate for each bracket resting on the tops of the tubes and clamped to the bracket, and a pair of rollers, one journaled upon the end of each bracket and adapted to engage and roll upon the respective guides or tables, substantially as described.

623,713—Motor Engine—Flavius Hayot, Paris, France, Filed April 13, 1898. Serial No. 677,490. (No model.)

A is a frame supporting the crank-shaft *B* in the bearings *C*. In this frame are fixed two standards, formed with two cylinders *E* and slide-guides *F*. Between the two standards *D* and by means of the guides *G* and pistons *H* is suspended the movable cylinder *J*, in which are reciprocating two pistons *K*, rigidly connected together by means of a transverse bar *L*. In the latter projects the pin of the driving-crank



M. It results thereby that the two pistons K K transform their reciprocating movement into a rotating movement of the crank, at the same time causing the lateral movement of the cylinder J.

The driving fluid acts only on one surface of the pistons, while the other surface remains open to the atmosphere. The fluid for the pistons K K is admitted by means of admission chambers N, through which it also escapes and which are located on and under the cylinder J, while the fluid for the pistons H arrives by opening O and escapes by opening P, located side by side in the cover. One opening Q, made in the wall of the cylinder J, permits the displacing of the latter on the driving shaft C.

This arrangement with four pistons will chiefly find its application where the work to be performed is liable to produce shakings or, as in gas engines, where the explosions produce ram-blows.

The advantages of this new engine are claimed to be numerous—suppression of the dead points, simplicity of construction, the pistons acting directly on the crank, and little room required. For a gas motor these advantages are very valuable, four explosions in succession being obtained, if desired, for each rotation of the crank. By their application to the gas motors the gas arrives on the pistons K K by two of the chambers F F, and escapes by the two others. The admission will thus take place on one side of the machine and the escapement on the other. In this effect the guides G are provided with holes, putting the chambers F F in communication with the chambers N N.

623,568—Explosive Engine—John A. Secor, New York, N. Y. Filed Nov. 10, 1898. Serial No. 696,016. (No model.)

623,778—Electric Igniter for Explosive Engines—John H. Frew, New Castle, Pa. Filed Oct. 2, 1897. Serial No. 653,778. (No model.)

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VOLUME 4

MAY 10, 1899

NUMBER 6

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VOL. IV.

NEW YORK, MAY 10, 1899.

No. 6.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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Expositions Galore in Europe.

Americans who are contemplating a visit to Europe this summer and who are interested in one way or another in the motor vehicle movement, will have every opportunity of increasing their knowledge of the progress that is being made on the other side, for at the present moment no less than four international expositions of motor vehicles are in course of organization there—one in France, two in England, and one in Germany. Judging from all indications the exhibition which is to be held in Paris in June next, under the auspices of the French Automobile Club, is likely to eclipse everything that has so far been done in this line. Already it is announced that 170 different concerns have applied for space, aggregating 5,876 square metres. The list of intending exhibitors includes not only all the old established makers, the details of whose vehicles are now fairly well-known, but

quite a number of new constructors, with novel designs of motors, transmission gear and carriage builders' work.

Concurrently with the Paris show, that of the Automobile Club of Great Britain, at Richmond, eleven or twelve miles out of London, will be running. The organizing committee are sparing no efforts to make this exposition a success. In addition to the show proper, a series of motor vehicle competitions is being organized.

The next show on the list is that which is being promoted by the proprietors of the *Motor Car Journal*, and which is to be held at the Agricultural Hall, Islington, London—a place familiar to many Americans as the locale of the Stanley cycle show—from July 3 to 15. The latter, although started by a private organizer, appears likely to be a very successful one, as the Agricultural Hall has the advantage of being very conveniently situated for visitors to London, and already it is announced that the major portion of the available space has been taken up. A feature of this exhibition is that no less than 32,000 square feet of the ground floor is being prepared as a demonstrating arena, in which, irrespective of weather, the vehicles on exhibition can be actually tried. In addition a series of trials and tests for motor vehicles is being prepared to be carried out both in the demonstrating arena in the building and in the adjacent public thoroughfares.

The last important motor vehicle show of the year in Europe will be that at Berlin, Germany, extending from the 3rd to the 28th of September next. This exposition, which is practically the first in Germany, where the motor vehicle movement has made comparatively slow progress as compared with what has been done in France and England, is being organized by the Mid-European Motor Club, of Berlin. It is international in character, and if current reports be true, several new types of vehicles will be exhibited for the first time.

It will thus be seen that the American motor student who intends visiting Europe this summer, will find much to interest him, and intending visitors would do well to make a note of the dates of the shows above given, as they will afford an invaluable opportunity of seeing what has been done both in England and on the continent.

Incrustation of Vehicle Boilers.

A subject which builders of steam carriages have said little about so far is the liability of small tubular boilers to crust and clog from impurities in the water used. The owner of a steam carriage will be compelled to use different kinds of water, some of which is likely to be strongly alkaline, leaving deposits in the tubes, and frequently clogging them entirely. What means the builders of steam vehicles have at command to remedy this defect we do not know, but we should be pleased to hear from them in regard to the matter. We understand that the Serpollet Co., of Paris, have had no little difficulty from this cause, and the annoyance and expense from incrustations in stationary boilers is well known.

It was suggested to the editor recently by a close student of motor problems that in high pressure boilers making steam so rapidly as those employed by Serpollet and our own builders, the impurities of the water would be held in suspension and could not form deposits on the tubes.

Will some one throw light on this subject?

The Personal Equation.

In estimating the serviceability or probable life of any machine, the personal equation must be taken into account, just as it is in estimating the wearing qualities of apparel and other personal effects. Some persons are more careless than others, or their personal habits are destructive of everything they wear or use. Hatters, clothiers, watchmakers and other tradesmen long ago discovered this, and so will manufacturers of motor vehicles. A motor carriage will give one man good service for several years, while another might knock it to pieces in a month or two.

In all estimates or guarantees of the term of life of machines sold to the general public, this personal equation must be taken into account.

Dos-a-Dos.

Manufacturers of motor carriages are paying a good deal of attention to the dos-a-dos style of rig, a French importation, which is well enough suited for horse vehicles in foreign lands when footmen or lackeys are to be distinguished from their betters, or for aristocratic Americans who ape foreign customs, but is not at all adapted to the wants of the average American purchaser. A little experience will demonstrate that the sensations of riding backwards in a motor carriage are most uncomfortable. The plea sometimes advanced by makers of gasoline carriages that the proper disposition of the motor and machinery in the vehicle body renders this arrangement necessary, will not hold. The body must be lengthened, then, to provide for two comfortable seats, accommodating four persons and both facing forward, so that all the occupants may see before them and converse together at their ease.

without craning their necks and without "hanging on for dear life" to prevent being dumped into the road, as one must do in this excruciating dos-a-dos fad.

Artillery Wheels.

We print in another part of this issue a communication from a leading firm of carriage builders suggesting that the columns of THE HORSELESS AGE be opened to the discussion of the suitability of artillery wheels for motor vehicles. The columns of the AGE are, and always have been, open for the discussion of every question that has an important bearing on the new industry it represents. The subject of motor vehicle wheels, however, is one of unusual importance, and we thank our correspondent for introducing it, and extend the widest invitation to all workers in this field to contribute to the discussion which we hope will follow. A free interchange of opinion will benefit all.

A \$200,000,000 Enterprise.

The plans of the big syndicate which has bought up the motor carriage department of the Pope Manufacturing Co., absorbed the street railway system of Chicago and organized a number of companies, capitalized at from \$3,000,000 to \$25,000,000, are beginning to take more definite shape.

The intention of the organizers of the enterprise is to establish a factory in Chicago, where all the vehicles needed in that center will be manufactured, and to keep the Columbia Automobile Co., at Hartford, busy supplying the demand in the eastern section of the country. Extensive additions will be made to the Columbia motor carriage factory, including a plant for the manufacture of storage batteries, the Columbia Co. having obtained from the Electric Storage Battery Co. an exclusive license to use their patents.

With manufacturing plants in Hartford, Chicago, and other centers the vehicles will be distributed to the various sub-companies holding exclusive licenses from the parent company. These sub-companies, so far formed, are the New England Electric Vehicle & Transportation Co., capital \$25,000,000; the New York Electric Vehicle & Transportation Co., capital, \$25,000,000; the Pennsylvania Electric Vehicle Co., capital, \$6,000,000, and the Illinois Electric Vehicle & Transportation Co., capital \$25,000,000. Other operating companies will be organized, bringing the total capitalization of the parent of this gigantic enterprise, the American Automobile Co., of New Jersey, up to \$200,000,000.

It is stated that 1,000 public cabs and carriages will be put into service in the streets of Chicago as soon as possible.

Waltham Co. Secures the De Dion Rights.

The Waltham Manufacturing Co., Waltham, Mass., who exhibited the 1,000 pound thousand dollar electric runabout at the last New York Cycle Show, have secured control of the De Dion gasoline motor for the United States, and will place on the market a line of tricycles, tandems and light carriages propelled by this well-known motor.



BROUGHAM. AMERICAN ELECTRIC VEHICLE CO., CHICAGO, ILL.



RUNABOUT. AMERICAN ELECTRIC VEHICLE CO., CHICAGO, ILL.



DOS-A-DOS. AMERICAN ELECTRIC VEHICLE CO., CHICAGO, ILL.



MAIL PHAETON. AMERICAN ELECTRIC VEHICLE CO., CHICAGO, ILL.

New York Electrical Exhibition.

The New York Electrical Exhibition opened at 8 o'clock, May 8, with three vehicle exhibits in place—the Columbia Automobile Co., the Riker Electric Motor Co. and the Indiana Bicycle Co. The exhibits of the Woods Motor Vehicle Co. and the American Electric Vehicle Co. had not arrived.

The Riker Co. had three vehicles in place—a surrey, a victoria, which had made 8,000 miles, and a new brougham of most substantial construction and superb finish, which is destined for a Paris customer. Several other vehicles, including

a phaeton, theatre 'bus and emergency wagon, will be added to the exhibit from time to time.

The Columbia Automobile Co., successors of the motor carriage department of the Pope Manufacturing Co., had six exhibits in place—an emergency wagon, a ladies' shopping victoria, a "quad" runabout, dos-a-dos, delivery wagon and a trap. They expect to have three more styles on view soon.

The exhibit of the Indiana Co. comprised four runabouts, a Stanhope and a buggy. A delivery wagon will complete their exhibit.

The American Electric Vehicle Co. will also show a delivery

wagon. We illustrate a number of styles of vehicles made by this company.

This company has on exhibition a runabout buggy, fitted with a multipolar motor of their own design and manufacture, of 1,600 watt capacity, rated at half saturation and capable of delivering double this power for a period of time without overheating. The battery equipment consists of forty-two 80-ampere hour accumulators, also of their own design and manufacture, rated at a five hour discharge rate. They promise a detailed description of these accumulators in the near future. The series parallel control gives five gradations up to a maximum of fifteen miles an hour. The wheels are fitted with $1\frac{1}{2}$ inch salient rubber tires and ball bearing axles. The rear wheels are 26 and the front 34 inches in diameter. The motor has a hollow armature shaft, through which passes the driving shaft, on either end of which is a steel pinion, meshing into a large feed gear, attached to the hub of the rear wheel of the vehicle. In this driving shaft is a differential gear automatically adjusting the different speeds of the rear wheels in turning corners. On the dashboard is a combination volt ammeter with a double scale which indicates the mileage capacity yet remaining in the batteries at any time. The charging apparatus is automatic and the vehicle, while simple in construction, is provided with conveniences and appliances which should make it practical in the hands of the ordinary purchaser.

Cannot Prohibit Them.

The suit against J. B. West, which was reported in our last issue, has brought the subject of motor vehicles prominently before the authorities of Rochester, N. Y. A number of citizens waited upon the Executive Board or called at Police Headquarters to protest against the use of motor carriages, particularly those propelled by steam, unless the owner shall furnish the city with a bond to indemnify it for any possible actions for damages which may be brought to recover for injuries caused by the operation of the motor carriage.

After giving the matter some consideration the Board concluded that it could not interfere with the rational use of motor vehicles, "especially those driven by electricity." The emission of smoke or steam and the dropping of hot coals they thought objectionable.

Krieger Cab Rights Bought by the Autotruck Co.

The Krieger cab, which was brought to New York recently by the English syndicate, holding the rights from the French company, struck the fancy of the magnates of the New York Autotruck Co., who quickly gathered in the rights to manufacture them in the United States. It is said to be the intention of the Autotruck Co. to put these cabs in service in New York under the cheap fare bill just signed by Governor Roosevelt, and under which they have obtained a franchise to operate the cabs on Fifth Avenue.

The Shepard Delivery Wagon Prepared for Hill-climbing.

Robert Barwise, the representative of the Indiana Bicycle Co., who is supervising the operation of the Shepard Co.'s

new delivery wagon, at Providence, R. I., has found it necessary to make some changes in the gear, which was too high for the steep grades, and in the speed of the motor, which was reduced to increase the braking power. The original speed was twelve miles an hour, the present speed is ten. Two more wagons will be sent on soon, the wheels of which will be equipped with auxiliary brakes the better to negotiate the steep hills on the eastern side of the city.

Duty on Motor Vehicles.

In answer to an inquiry made by the French Government as to the duty on motor vehicles or parts thereof imported into the United State, the Treasury Department has replied that such vehicles will be subject to duty on importation at the rate of 45 per cent. ad valorem, as articles or wares composed wholly or in part of metal, under paragraph 193 of the Act of July 24, 1897.

Acetylene as a Power Generator.

The recent annual meeting of the German Society of Gas and Water Experts in Nuremberg, was made the occasion for an exhibition of acetylene and its applications.

In reference to the application of this interesting product to the gas engine as a power generator, *Dingler's Polytechnisches Journal* has the following comments that will be read with interest by American engineers, to most of whom such application will doubtless be new:

The principal difficulty hitherto encountered in applying acetylene as a motive power lay in obtaining a non-luminous flame—the evidence of complete combustion—without danger. This difficulty, our authority declares, is now overcome by the devices constructed by one of the Berlin acetylene companies.

It is stated, in the same connection, that acetylene is now applied in power generators (gas engines) in the same manner as ordinary coal gas and water gas. In order to obtain the full output of the energy of the gas it must be mixed with air in the right proportion to produce perfect combustion, which is indicated by a non-luminous flame. The power developed by the explosion of acetylene completely burned in the cylinder is said to be much greater than that obtainable with water gas.—*Journal of Franklin Institute*.

Proposed Motor Tricycle Race from Boston to New York.

Editor HORSELESS AGE:

In regard to Mr. Skinner's challenge I wish to say that I am perfectly willing to race the gentleman from Boston to New York, as first proposed. I understood that Mr. Skinner was in town a week ago and had hoped that he would communicate with me regarding arrangements. Business engagements will not allow me to leave the city at present, but I would be pleased to have the date of the race set some time in the latter part of June. I am very anxious to have the two machines judged in regard to other points besides speed: manageability, simplicity, noiselessness, appearance, etc. Perhaps the editor of THE HORSELESS AGE could arrange a competition of this kind for us. Of course, this has nothing whatever to do with the speed contest.

A. FISCHER.

LONDON NOTES.

It is reported from Papenburg, Germany, that large new motor vehicle works are about to be established in that town.

The Dresden Gasmotorenfabrik Gasellschaft (late Moritz Hille), of Dresden, Germany, makers of the Hille motor tri-cycles, reports a profit for 1898 of \$37,015, out of which a dividend of 8 per cent. is being declared, as compared with only 4 per cent. in 1897.

La Société des Automobiles Canello-Durkopp, is the title of a company which has just been formed at Courbevoie (7 Villa des Bruyères), France, with a capital of \$200,000.

It is reported that Liverpool, like London and New York, will soon have a service of electric cabs. A syndicate is being formed with that object and according to reports, the system of vehicle to be adopted is not that of the London Electrical Cab Co., but that of Carl Oppermann, of Clerkenwell, London.

The house of Wadsworth, of Westgate, Halifax, England, are at present engaged on the construction of a steam road-sweeping machine.

The International Motor Car Co., of Kilburn, London, has just introduced an attractive new design of Benz gasolene carriage. The new departure is in the body of the vehicle and not in the mechanism, which is now on a settled basis. The carriage has accommodations for three passengers, but instead of one rider having to sit with his back to the direction of running, the seats are arranged char-à-banc fashion, the front seat being reversed. In addition to permitting the rider to face the direction of running, the new arrangement gives considerably more "leg room," and is claimed to be easier to mount and dismount.

In the Queen's Bench Division of the British Courts on the 26th ult. was heard an action brought by Roots & Venables, of Westminster, against the Daimler Motor Co., Ltd., of Coventry. Both concerns are builders of motor vehicles and both took part in the motor vehicle trials organized by the Royal Agricultural Society, at Birmingham, last summer, from Bassett's Hole for a distance into the country and for the return journey. In this competition the plaintiffs had a motor van and the defendants a wagonette, and when a mile or two on the road had been traversed, a collision occurred between the two vehicles, and the plaintiff's van was a good deal damaged.

The plaintiffs sued for damages in consequence of the injury done to their van, claiming negligence on the part of those who managed the defendant's wagonette.

A good deal of evidence was given on both sides, the jury in the end giving a verdict for the plaintiffs to the amount of \$250.

In connection with the motor vehicle exhibition to be held at Richmond a prize of twenty guineas is being offered for the best device by which the burners of gasolene motor vehicles having tube ignition, shall be automatically extinguished in the event of a vehicle assuming, from an accidental cause, such an angle with the road that there would be danger of its overturning. Competitors must send in their names by May 13 to the secretary of the Automobile Club Show, 4 Whitehall Court, London, S. W.

Steps are being taken to form a Scottish Motor Car Club, on the lines of the Automobile Club of Great Britain. In fact, it is proposed that the new club should form a branch of the last named. A meeting of chauffeurs is to be held in Glasgow on May 3 to consider the question. In Birmingham, too, a branch of the Motor Car Club has just been formed.

Duryea Mfg. Co.'s Light Delivery Wagon.

The Duryea Manufacturing Co., Peoria, Ill., are preparing to put on the market a light delivery wagon, weighing only 800 pounds, and using the same machinery and arrangement of parts as their motor trap, the only changes being larger tires, heavier wheels and a longer covered body. The main floor of this body will be the regulation height from the ground, and the cushions, with folding backs, will rest on the forward end of the floor. Below the rear end of the floor and following the general outline of the body, is a large receptacle, closed by a downwardly opening door at the rear end, in which parcels may be placed.

The wagon is stylishly and artistically designed, with curved roof, oval plate glass side windows and large side panels. Unless otherwise ordered, the rear end will be closed with a curtain only, for it is so convenient to handle parcels from the front end that little use is made of the rear end except for heavier packages and for loading. The forward portion of the floor under the cushions is removable, so that the machinery may be easily reached if desired, and without interfering with the load in the wagon. The vehicle is close to the ground, which renders getting in and out quick and easy, and saves much time and exertion in the course of a day.

A single lever in the center of the seat steers, changes speeds and stops or starts, the steering being done by a horizontal motion, and the other operations by a vertical, while a rotary motion throttles the motor. A safety button centrally located on the handle prevents accidental starting. The position of this button indicates by sight or touch the various positions of the motor throttle. For example, button to the right is starting position; button forward is full power, and button to the left is stopping position of the motor. A foot brake lever centrally located near the dash operates a very powerful hand brake in the large sprocket and gives perfect control of the vehicle at all times. A pointer on the controlling lever just below the handle indicates the direction, forward meaning forward direction and backward meaning a reverse.

A triple cylinder motor, with $4\frac{1}{2} \times 4\frac{1}{2}$ inch cylinders, works on a crank shaft, with cranks set at 120° from each other. This gives an impulse each two-thirds of a revolution, which is very nearly a constant application of power, and insures a very steady running motor and little or no vibration to the body of the vehicle. Should accident affect one cylinder, the other two will do larger duty and permit the drive to be continued. A light fly-wheel suffices and enables the weight to be reduced below the weight of other constructions. The speed gear gives a slow speed forward for hill climbing and heavy roads, and a slow speed reverse, while in ordinary speeds the gearing is entirely inactive and serves to add its weight to that of the fly-wheel. This arrangement is claimed to add to the life of the working parts, obviate noise and odor, and decrease the liability to get out of order.

A knurled knob at the base of the controlling lever regulates the fuel supply. When the vehicle is not in use this should be closed, although no harm is said to result if it is not done. It is opened wide for starting and is then adjusted to any desired position, causing perfect combustion under all normal circumstances, and when properly adjusted there is said to be no more odor from the motor than from an ordinary gasolene stove. In starting, or just as the motor

ceases firing in stopping an imperfect combustion may result and some odor be thrown off, but these conditions last for an instant only.

When great power is required, the supply valve is opened to feed a slight excess of fuel, and this results in a combustion not quite perfect and some odor, but the motor is so powerful that there is seldom occasion to waste fuel in this manner.

The use of triple cylinders not only insures steady running, but divides the power into three parts of small size, which lessens noise of the exhaust. Careful attention has been given to the other moving parts, so that there is practically no clack and clatter around the vehicle, and by actual test it cannot be heard more than one-half as far up the street as can the ordinary horse vehicle drawn at the same rate.

The supply valves admitting the charges to the cylinders are automatic. The exhaust valves are operated by a single cam shaft, which also operates the sparkers. Crank shaft, crank pin and wrist pin bearings are all very large.

An automatic valve on the mixing device helps to control the supply of fuel, but its imperfect action does not affect the result. No pumps are used. All parts of the machinery are in plain sight and may be reached from the top of the vehicle when the seats are removed.

To start the motor a light nickel plated crank is fixed to the end of the motor shaft by inserting it through a small opening in the side of the vehicle and a couple of turns given. A ratchet provided detaches the crank, and it may be placed in the wagon until further needed. It is so easy to start the motor that in most cases it is stopped whenever the wagon stops for any length of time, to save the wear of the motor and the waste of fuel.

Water for cooling purposes circulates through the water jacket by gravity and requires no attention. The fuel tank holds a supply for 150 miles or more on good roads. Both tanks are made from one piece body with ends riveted, flanged and soldered in place and are practically unbreakable. The only opening through which fuel passes from the fuel tank can be closed by the knob controlling the supply, and in this is done there is no possibility of leakage, but an automatic closure is supplied, which insures safety even if this valve is not closed.

Ball and anti-friction bearings are employed on all journals with the exception of the motor parts, which are self-oiling.

Pneumatic tires of special construction and kept pumped up hard, are preferred. On the tread they are half an inch thick, and are consequently almost unpuncturable.

The rails, top standards and other minor parts are finished in nickel, and aluminum caps protect the driving wheel hubs. The vehicle can be washed with a hose like any horse vehicle without damage to any part.

The Duryea Manufacturing Co., Peoria, Ill., have steadily pushed ahead until they are able to make motors faster than vehicles, and so have a few motors for sale. These motors are the design of Chas. E. Duryea, the originator of the Duryea vehicles and embody the results of a good many years' of experimental work in this line. Although weighing only thirty-three pounds per H. P., they have large bearings and have stood some rough service. The motor is the soul of the vehicle, and the multi-cylinder motor is believed by many engineers to be the future form for vehicle use. We are promised photographs of both the horizontal and vertical forms soon.

The Criterium for Motorcycles.

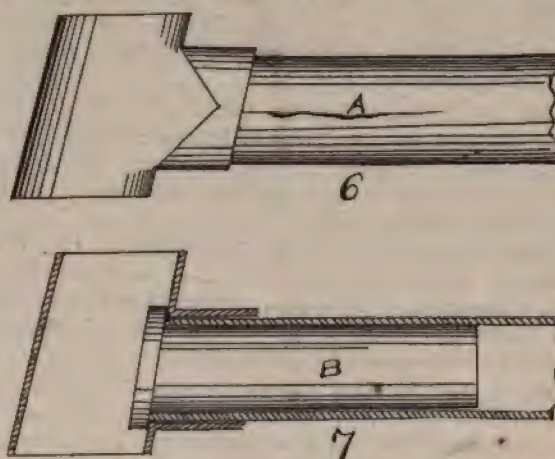
The Criterium for motorcycles, organized by *Le Velo*, was run off in April, between Etampes and Chartres, a distance of about sixty miles. Inasmuch as the maximum weight allowed was about 225 pounds no Bollee voituresses started. Several Werner motor bicycles undertook to cover the ground with the tricycles but failed. The tricycles, mostly De Dion's, had one and three-fourth H.P. motors with two exceptions, which were fitted with double motors, although the apparent advantage was not shown at the finish. One rider had a three H.P. motor, another a two and one-half H.P., all built on much the same lines as the De Dion.

Velo has decided to organize separate contests for motor bicycles and voituresses.

Notes on Repairs.

FIXING A SPLIT TUBE.

In Fig. 6 at (e) is a sample of split tube next the head lug. To repair this and strengthen the joint, a sound piece six inches long was then cut from an old tube. Not being able to find a piece just exactly of the right size we took a piece that was 1-16 inch too large, and turned it in the lathe until it was a



fit as at B, Fig. 7. A good welding heat being taken on one end of each piece of tube, both being fluxed well, the piece of turned pipe was thrust through the shorter piece of tube, then pushed through the swage, and into the end of the tube. A few quick blows with a light sledge welded the tube, and raised a ridge half an inch high all around it. The ridge thus upset was hammered down while the tube was in the swage.

To Make Tubing for Motor Vehicles.

The Wilmot & Hobbs Manufacturing Co., Bridgeport, Conn., are building additions to their large factory and expect soon to double their force of 600 hands, owing to the excessive demand for their new brass-lined safety cycle tubing. The company is also contemplating supplying motor-vehicle manufacturers with this tubing, which is prevented from rusting by a thin even lining of brass.

MINOR MENTION.

A motor vehicle service is talked of this summer between Port Jervis and Milford, N. Y.

The Washington Automobile Co. expects to have several electric carriages on the streets this week.

The General Electric Automobile Co. has purchased the old Inquirer paper mill at Manayunk, Pa., for an electric vehicle factory.

The National Motor Co., capital \$50,000, has been authorized to operate motor carriages in the parks of Buffalo, N. Y. The directors are John Laughlin, Michael H. Purcell, James Delahmet, Henry J. Skinner and Henry Hoffeld.

Papers have just been filed with the Secretary of State of Maryland, incorporating the Crouch Automobile Manufacturing & Transportation Co., of Baltimore, with a capital of \$250,000. The Crouch steam carriage was described in our issue of April 5.

The item in our last issue to the effect that the New England Motor Carriage Co. had moved into the Fifield factory at Lowell, Mass., was erroneous. The New England Co. has fitted up a factory at Waltham, Mass., and will have vehicles on the market in June.

The American Electric Manufacturing & Power Co. has been incorporated at Dover, Del., with \$1,000,000 capital, to make motor vehicles of all kinds. The incorporators are Henry E. Cain, William M. Baldwin and Howard L. Mendenhall, all of Philadelphia.

The St. Louis Motor Carriage Co., St. Louis, Mo., has been incorporated with a capital of \$30,000 to manufacture gasoline motor vehicles. The incorporators are Joseph French, John L. French, G. P. Dorris, Callie French, H. E. French and Jesse French, Jr.

The Illinois Electric Vehicle & Transportation Co., Chicago, Ill., has secured the plant of the Siemens-Halske Electric Co., of America, at Cicero, Ill., formerly the Grant Locomotive Works, and will immediately make the few changes necessary to manufacture all kinds of electric vehicles.

On May 2 the Columbia Electric Vehicle Co. was incorporated in New Jersey, to manufacture and operate motor vehicles driven by electricity or other power. The incorporators are Charles A. Wendell, Andrew H. Scobel, Anthony N. Jeshera, Sherman M. Granger, Francis R. Foraker, Walter T. Dryfoos and Roland B. Harvey, of New York, and W. B. Greely, of New Rochelle.

Ten thousand shares of the preferred stock of the International Automobile & Vehicle Tire Co., of New York, are offered for public subscription by Brown, Bruns & Co., of New York, and John W. Belches & Co., of Boston. Seventy-five per cent. of common stock is given as a bonus with the preferred. The company has \$1,500,000 7 per cent. non-accumulative preferred and the same amount of common stock.

The Chicago Electric Vehicle Co., said to be independent of the Chicago Electric Vehicle & Transportation Co., was incorporated in New Jersey last Friday, with a capital stock of \$1,000,000. The charter gives the company the right to manufacture, operate and deal in electric conveyances of every kind. The incorporators are Orson D. Fox, Smith C. Shedrick, John Trier, Gustav Lukas, M. M. Chesroun and J. W. Creekmurall of Chicago and David Harvey, Jr., of Asbury Park, N. J.

THE HORSELESS AGE.

VOL. 4. No. 6, May

Warren F. Lewis, a carriage manufacturer, of Plantsville, Conn., contemplates the manufacture of motor carriages.

The Electric Vehicle Co. proposes to increase its capital stock from \$10,000,000 to \$12,000,000 in common stock of a par value of \$100.

Mayor Ashbridge, of Philadelphia, has asked the Council to note the increase of the motor vehicles on the streets, and advises that they be taxed like other vehicles.

John M. Walshe, manager of the Electric Specialty Co., 117 North Warren street, Syracuse, N. Y., has invented a storage battery and made arrangements with the Cortland Wagon Co., Cortland, N. Y., to make electric vehicles for him. It is said the vehicles will weigh only about 500 pounds.

The Indianapolis Transfer Co. has been organized with a capital stock of \$15,000 to introduce motor vehicles in the Indiana capital for the transfer of both freight and passengers. The company has bought the premises at 215 North Delaware street. John E. Morand, W. E. Stevenson and W. F. Churchman, of Indianapolis, and W. H. Worth, of Cincinnati, O., are the interested parties, Mr. Morand being president and manager. It is said electricity will be used.

The officers of the International Automobile & Vehicle Tire Co., which has bought out the plants of L. C. Chase & Co., Chelsea, Mass., and the Newton Rubber Works Co., Newton Upper Falls, Mass., and the patents of the American Tire Co., are Edward E. McCall, president; Richard Croker, Jr., vice president and manager, and A. H. Alden, of the New York Commercial Co., importers of crude rubber, treasurer. After the 12th of May the offices will be in the New York Life Building. It is said that Richard Croker, now abroad, will float a sub-company in England.

QUESTIONS AND ANSWERS.

At the request of many of our readers we have decided to open a department of questions and answers. We will endeavor to answer any detail question in practical engineering pertaining to motor vehicles.

Artillery Wheels.

NEWARK, N. J., May 6, 1899.

Editor HORSELESS AGE:

We are in receipt of a communication from one of the leading builders of motor vehicles in London, requesting us to favor them with our views for and against the use of artillery wheels in their line of business. If you will open your columns to a full discussion, we should be greatly pleased to hear what some of your practical subscribers have to say on the subject.

Yours very truly, J. M. QUINBY & Co.

Answer to O. O. Bull & Co., Christiania, Norway.

The snow in Norway, we presume, is dry and hard during the entire winter, and would afford a good surface for motor vehicles. There might be a few days in the spring when the snow was passing off and the tires cut through to the frozen surface of the road, when some additional device, like rope or a spiked attachment, would be needed, but these devices, whatever may be decided upon, will soon be in the market at reasonable cost, so that the motor vehicle would appear to be practicable the year round in Norway.—ED.

OUR FOREIGN EXCHANGES.

New Petroleum Motor for Tricycles.

In consequence of the increasing popularity of motor tricycles in France, quite a number of firms in that country have laid themselves out to meet the demand for the same. Many of these firms are employing the well-known De Dion motor, but during the past few months several small motors of the same type, but which are claimed to possess certain advantages over their older prototype, have been put on the market. Among these is the Société des Moteurs "Cosmos," of 67 Rue de Provence, Paris, whose motor—the "Cosmos"—we are now able to illustrate in Fig. 1 and Fig. 2, and describe. The motor, which is of the single-cylinder vertical type, is built up of three main parts, each entirely distinct from the other—B, the valve and explosion chambers; F, the cylinder proper; and H, the oil-containing dust-proof casing, in which work the piston rod D and crank disc L. The cylinder F is a casting of special homogeneous iron, the outside and inside being both machined to remove any inequalities, the outside being provided with a series of ribs running lengthwise with the cylinder, forming, as it were, a very wide spur wheel. The ribs or ridges of the cylinder barrel are entirely enclosed, except for a short space at the top and bottom, by a heat absorbing polished copper jacket, G. The makers claim that the openings to the space between the ribs thus formed at the top and bottom of the exterior of the cylinder assist materially in inducing a current of air to circulate round the cylinder, and so keep the latter cool.

Referring now to the sectional view, Fig. 2, it will be seen that the piston is of special construction. The piston rod D is pivoted to the piston P. The latter is provided with a special cap or cover of nickel, held in place by the piece C and the large bolt shown. The advantage claimed for the use of this cap is that it forms a hermetic joint, preventing any escape of the gases at the side of the piston, the force of the explosion acting on the concave end of the cover, and forcing its sides against the walls of the cylinder. The piston rod D is con-

nected at M to the disc L on the motor shaft K. The admission valve is worked automatically, while the spindle of the exhaust valve A is actuated by a cam mounted on a short shaft driven by spur wheels I J off the motor shaft, the two spur wheels being contained within the casing H. The latter is provided with a removable cover, N, in order to render the working parts of the motor readily accessible. The ignition is effected by means of an electric sparking arrangement, which may be advanced or retarded as desired. The "Cosmos" motor, which normally runs at a speed of 1,200 revolutions per minute, is being made in two sizes—1½ and 2½ actual H.P. The makers claim that their motor is the only one that can seriously compete with the well-known De Dion-Bouton motor, and that for its weight and the space it occupies it develops a greater power than any other engine of the kind. The 1½ H.P. motor is stated to weigh, without flywheel, only 55 lbs., and the 2½ H.P. only 61½ lbs., the dimensions being respectively 15 in. by 5½ in. by 10 in., and 16½ in. by 6 in. by 11 in. Another point claimed for the motor is that all the parts are made on the interchangeable system, and each being plainly marked with a letter or number, it is a simple matter to obtain a duplicate part in case of accident, etc.—*Motor Car Journal*.

London Street Traffic.

Says an English contemporary:

The traffic of London is the eighth wonder of the world. Its management is the ninth. But how is it managed? By rigidly prohibiting tramways where the traffic is the greatest. There are no tramways in the center of London. The much and unjustly abused corporation has had more sense than to tolerate them. But the omnibus is encouraged. Omnibuses go where they please, and serve the public well. A tramway across the London Bridge, which is, we suppose, the busiest thoroughfare extant, would stagnate the human vehicular stream at once. But omnibuses are incessantly traversing the bridge. They cross it in hundreds, and probably in thousands, daily; and the horse-drawn omnibus of to-day will be the motor omnibus of to-morrow. Few will question that who witnessed the commencement of the Easter tour of the Automobile Club yesterday, and observed the great advance made by the horseless carriage in a year. The sooner the change is effected the better, since the room occupied by the horses will then be saved.

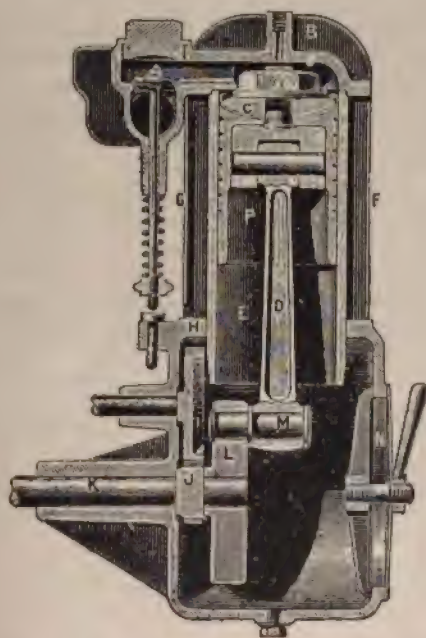


FIG. 2. ELEVATION OF "COSMOS" MOTOR.

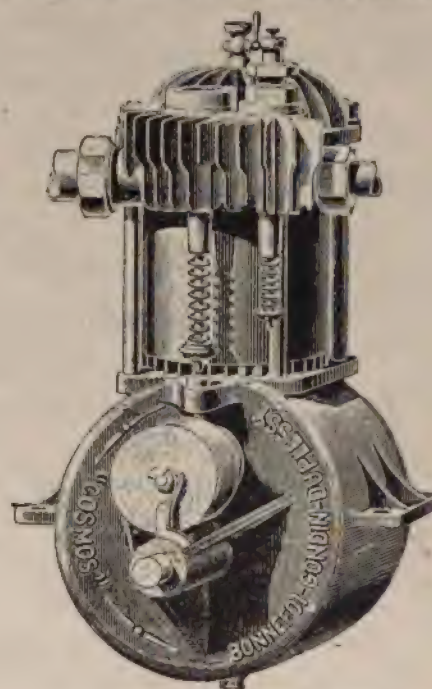


FIG. 1. "COSMOS" MOTOR

LESSONS of the ROAD

Users of motor vehicles are invited to contribute to this department for the good of the industry.

Comicalities of the Horse.

PEORIA, ILL., May 1, 1899.

Editor HORSELESS AGE:

It seems to the writer that the stupidity of drivers is responsible for more trouble from the horse than the horse's own lack of sense. A horse is not supposed to have a high degree of intelligence and should not be condemned for not exhibiting more than he has.

Some horses lack sense, of course, and cannot be taught, but most of them are reasonably tractable, and lack of intelligence reflects upon their masters. Most horse accidents, now so common, would not occur if reasonable care or diligence were exercised by the drivers.

One of the cleanest upsets I ever saw was manipulated by a sleepy junk dealer, driving a steady old rattle-bones of a horse to a rickety old wagon, loaded high with rubber boots, old hose, scrap lead pipe and a small calf, with legs tied.

The horse saw the motor vehicle coming while yet some distance away and turned down a cross road, quickening his pace into a trot. This acceleration of gait awoke the driver, who grabbed for the lines, got hold of one, and proceeded to pull the horse up. The result of course was an upset, unloading the calf with the junk on top of him and spilling the driver off just clear of the overturned wagon.

The harness let go and the horse ran back toward the motor wagon and was caught by a bystander. We helped set up the wagon and left the driver to load up his junk at his leisure, for we felt that he was the whole cause of the trouble and that he deserved what he got. But we did feel sorry for the calf.

Another incident from like cause occurred with a small, nearly blind, boy, driving while his mother sat on the seat beside him. The boy did not see the motor vehicle approaching, and his mother was so engaged in watching it that she neglected to think of either horse or boy.

The horse was so sleepy and sedate that the motor vehicle's pace was not slackened much, and before the horse had time to think the vehicle was upon him. A sudden bolt sidewise across the gutter dumped the wagon over and the passengers out.

The motor vehicle stopped to help in the matter, the horse was soon caught and the woman and boy, more interested in the motor vehicle than in their own, seemed thankful to have an opportunity of examining one of the horseless rigs. Little or no damage being done and nobody being hurt, we all went our ways rejoicing.

It is quite evident to the writer that a horse enjoys a joke occasionally. Not long ago, while driving out in the suburbs, parallel to a street car track, we were speeding along at twenty miles an hour and just keeping in advance of an elec-

tric car whose motorman, conductor and passengers were enjoying the race. A strong, intelligent horse, hitched to an American Express Co.'s wagon was met and passed, bringing the horse between our path and the street car track.

Both driver and horse were watching us, and the horse saw an opportunity to have a little joke of his own. He therefore gave a playful little jump away from us, as if he were scared. This jump, however, brought him in front of the rapidly approaching electric car, and he at once awoke to the fact that the joke might prove serious, so a second jump brought him so far back our way that had we not been going rapidly he would have collided with the vehicle, showing very plainly that he had no particular fear of us.

The incident happened so quickly that the driver really had no hand in it, and it was quite laughable to see how quickly the horse changed his mind. It is a very common experience to find drivers who do not have their horses under control and make no effort to guard against possible danger until the damage has been done.

A little observation will show dozens of drivers every day allowing their horses to go as they please, without attention, and with lines hanging loosely, and it is a wonder that more accidents do not happen from such carelessness. Some futile attempts to manage the horse in a sudden emergency are really laughable.

While skimming along over a country road one lovely afternoon an old horse and phaeton, with a gray haired, spectacled, motherly woman driving, was seen coming ahead of us. The horse threw his ears forward long enough to take a glance at us when some distance off, and then went to sleep again.

The old lady watched us with wonder, but with perfect confidence in her security. We turned out far enough to clear, and, though at slackened speed, were soon upon them. This rapidity of movement was not counted on by the horse, so he woke up once more and proceeded to back up into the phaeton.

The old lady lurched forward because of the sudden stop, extended her arms in a vain attempt to push on the lines and stared at us over her spectacles as if wondering what was coming next.

The old horse, with feet braced and back humped up, the useless lines hanging in long loops, like grape vine swings, and the helpless position of the old lady leaning forward as if trying to push the horse out of the buggy, made a picture too comical to be forgotten soon. It was sooner done than told, however, and no damage resulted.

While it is not so recognized by horse users, the fact remains that a pair of lines and a whip are very inadequate for controlling a powerful animal.

It is not natural for one's arms to be everlastingly held out forward, and the result is that the driver is generally not prepared for emergencies. Because of these facts the writer believes that motor vehicles should have their controlling lever in a comfortable position for one hand to remain continually on it, and that this lever should not only steer the vehicle, but that it should stop, start and control the speeds as well.

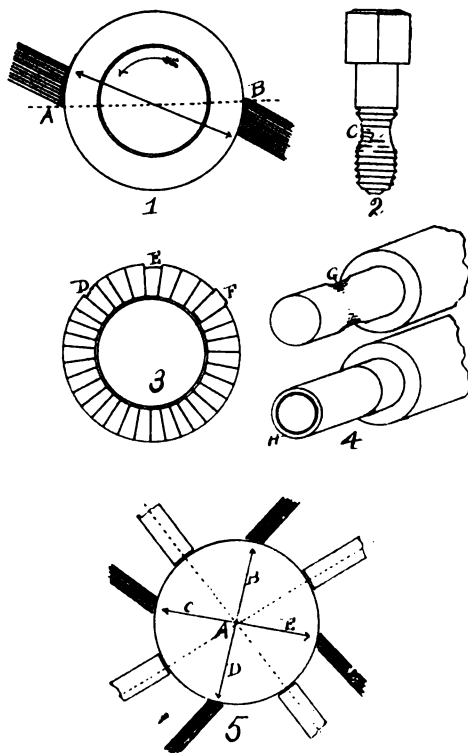
This arrangement assures that no time is lost in grabbing for the lines or whip as in horse driving, and it is well known that the motor vehicle responds instantly to brake or lever, while a horse takes his own time. If the public knew these facts, they would realize the safety of the motor vehicle and favor it instead of condemning, as they often do.

CHAS. E. DURYEA.

Motor Vehicle Engineering.

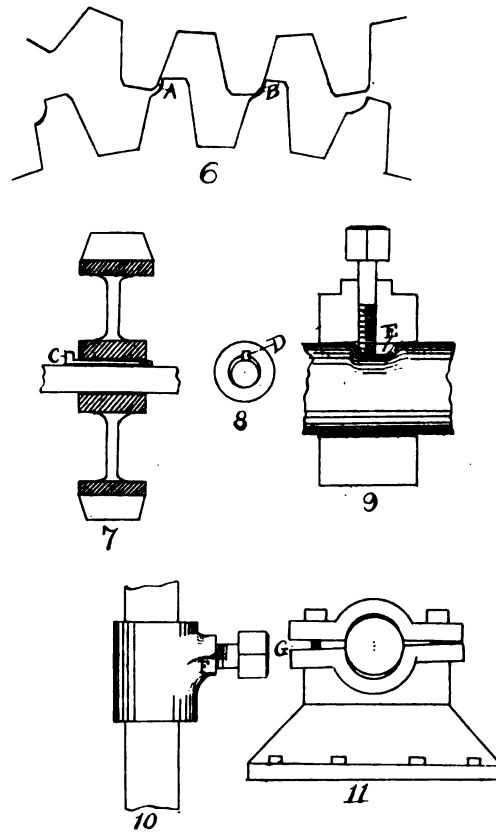
CARE AND REPAIR OF ELECTRIC VEHICLE MOTORS.

Apparatus for electric motor vehicles, and for charging plants for electric vehicles, like all other machinery, requires a certain amount of care and repair. Some of the first forms of electric motors for motive power in vehicles gave much trouble, owing to the heavy gearing and complicated mechanisms employed for transmitting the power to the wheels. Numerous troubles arose from the heating of the mechanical parts, sparking, motor stopping and failing to start, dynamos failing to generate, noises and varying speeds. Some motors which operated satisfactorily on smooth surfaces for exhibition purposes, utterly failed when the vehicle was run over a rough road or on grades. There were difficulties experienced in obtaining new parts for duplicates, and the lack of experience of machinists with this class of machinery also hindered the electric motor. But at the present time the builders of electric motors have so far perfected their machines that the mechanism is not only more effective, but much easier to operate and keep in order. There are also a number of motor vehicle engineering and repair shops in the principal cities, so that it is easier to get a motor repaired and adjusted than formerly. Sometimes a vehicle is run into one of these shops on the complaint that the motor is sparking, rattling, operating with jerks, or failing to drive at stated speed, and an examination shows that the whole trouble is due to the slipping of a set-screw, or the shifting of some part. Take the matter of sparking. An overloaded motor will cause sparking at the commutator, as also will a tight bearing which prevents the



shaft from turning freely. Armature striking the pole pieces also producing sparking. The brushes may not be at neutral points and the machine should be examined to determine this.

Fig. 1 is a plan for adjusting the brushes. I usually find the neutral points by drawing a line from a to b and then line up the brushes as shown. It is a good plan to examine the set-screws of the brush stands and if any of the screws are broken at the threads as at c Fig. 2, they should be removed



and replaced by new ones. I find that the threads are sometimes stripped from these set-screws by the operator of the carriage trying to make an adjustment, and as he is seldom a mechanic, he destroys the screw.

LOW BAR.

An inspection should be made for low bars, high bars and rough bars. A section of the commutator is given in Fig. 3, in which d shows the usual type of rough bar. The roughness is usually removed with a file, which I find better than the oil and emery method, because when the latter process is used, there are always pieces of hard emery left clinging to the parts which grind and cut for a long time after. I have known pieces of emery and sand grains from sandpaper to lodge in the copper and bother for months. Of course if the bar is badly roughened, it should be replaced with a new bar. A sunken bar like that at e is easily rectified by elevating, while the high bar at f is merely pushed down again into place and secured.

IF THE BEARINGS ARE WORN.

A motor shaft which is worn, as shown at g, Fig. 4, is readily repaired by putting the shaft into a lathe and turning off the surface of the bearing deep enough to reach below the worn portion and far enough in to make a shoulder beyond where the metal is worn. Then a sleeve can be turned out and slipped over the end, up to the shoulder, as represented by h, Fig. 4. This sleeve should be shrunk on and

the shaft trued up in the lathe, after which the bearing will be as good as new.

FOUR-POLE MACHINE.

Fig. 5 shows a good way to set the brushes on a multipolar motor. The brushes are adjusted at 90 degrees at the points determined by the arrows b, c, d and e. These extend from the center, a, and can be varied according as the adjustment requires a precise diametrical setting or not.

INSPECTION OF GEARS.

All gearing should be inspected whenever the motor is in the shop. Builders of electric motor gearing are very particular about the design of the gears and the adjustment. But after the motor gets into the possession of the purchaser a loose nut or a weak part may allow the cogs to move out of correct running position. Recently an electric vehicle failed to run well and upon investigation it was discovered that two of the connecting gears were set so far apart that the points of the teeth of one gear almost rode upon the points of the teeth of the other gear, as shown in Fig. 6. The result was that the smaller gear had its teeth worn off as at a and b. At times the gears would slip a cog and severely rack the machine. This was remedied by resetting the gears so that the cogs would mesh clean and yet not bind.

A WABBLY GEAR.

A gear out of line, wobbly or poorly balanced is very detrimental to the smooth running of a motor carriage. The writer had a case of this sort lately in which the original gear had been broken and the machinist had replaced it with another of the same size, but of larger bore in the hub. When the key c was driven into place, as in Fig. 7, the hub was of course elevated on one side beyond its center and resulted in a gear which would mesh deeply into its corresponding gear for half of its turn, while the teeth almost rode when making the other half. Fig. 8 is another view of this adjustment, showing how the key pressed the hub upwards at d. The motor operated unsteadily and the gearing made a binding sound, which was rectified by fitting a bushing into the hub and boring through the hub and bushing for two set-screws, using the latter for fastening to the shaft instead of a key.

UNRELIABLE ADJUSTMENTS.

Cut places in shafts beneath set-screws as at e, Fig. 9, are not often found on new machines. Such places may be found in some of the older motors, and when the machinist adjusts a part to the shaft by means of the set-screw, he is surprised to find that in a short time the part is slipped out of line because of the point of the set-screw lodging in the cavity e. These shaft "holes" are made by hard-pointed and sharp-pointed set-screws cutting into the metal and gouging it out under the strain of the part which the set-screw is holding. In time this mechanical action makes quite a hole, often with sloped sides, into which the point of a screw works itself and upsets the careful adjustment previously made. A good practice is to turn the shaft so as to present a new surface to the screw. Or the set-screw may be dispensed with and a key seat sunk into the shaft and part, and a key used.

INSPECTION FOR CRACKED PARTS.

Careless operators frequently apply the wrench with so much power to an adjusting screw that the part into which the screw goes is cracked as at f, Fig. 10. Dirt and gummed matter may work into the crack and fill it, so that the defect will not be observed. The chances are that the mechanical action due to the vibration of the vehicle is making the weak place dangerous by expanding the crack, which may ultimately

break through to the shaft. If on inspection defects of this sort are found, new parts should be substituted, or if a duplicate is not available, a cracked shoulder like that in the illustration can be strengthened by turning off the shoulder even and shrinking a wrought iron ring over it.

CAPS NOT THE RIGHT SIZE.

Very good motors are often rendered unserviceable by poor mechanical fittings on the shafts. Several cases like that in Fig. 11 have come to notice recently. The caps of the boxes were in some way loosened and lost and caps of another size used. The consequence was that the cap was so large that it allowed the shaft to wobble or it was so small that it did not fit correctly as shown at g, Fig. 11. Sometimes the space at g is filled in with leather packing, but this is an unreliable method, as the leather soaks up the oil from the bearing and makes a bad job of it. The proper way to do is to use only the right sized caps, which can be procured from the builders of the machine.

HORSELESS VEHICLE ENGINEER.

Regenerative Controllers.

John C. Henry, an electrical engineer, of 115 Irvington Place, Denver, Col., who has made a special study of regenerative controllers for traction purposes, says in last week's *Electrical World and Electrical Engineer*, in regard to an article in a previous issue of that valuable journal:

The results obtained in practice are very much of an improvement over Mr. Booth's figures. His statement that the use of regenerative controllers for electric automobiles has been abandoned in France, where they were largely used (because they stripped the gears), must be startling to a mechanic, and at the same time suggestive that there is a great deal of energy wasted which might be bottled up and used again to advantage.

While my figures have never been tabulated, as they would vary so much under every style of motor or different road, I am certainly convinced that in ordinary street railway practice we recoup to the line fully 30 per cent. of the amount of power absorbed in operating the cars, and as this returned energy is mainly absorbed by the cars near by, the losses in the line and track (which are usually very considerable), are avoided. One of my observations is that a 15-ton car descending a 6 per cent. grade, at a speed of twelve miles per hour, will generate sufficient current to run three cars on the level at about the same speed. To show how sensitive this method of control is, we might note that when running the car on the level the differential ammeter and watt recorder will reverse directions, caused by changes in the line voltage.

The efficiency of reconversion by the regenerative method depends greatly on the operator. The stops may be so slow that the energy of momentum is entirely absorbed by the friction of the motor car, etc.; or they may be so quick that these inherent losses show trifling figures. In the former case the gain would be nil, while in the latter the efficiency with good apparatus might be as high as 60 or 70 per cent. Mr. Booth's figures seem to be faulty. For instance, he gives the power necessary to ascend a 10 per cent. grade as five times as great as that necessary as on the level. Rankine's formula, $5 \cdot 1 \cdot 3 (\sin \phi + .0045)$, shows that 10 per cent. grades require over twenty-three times as much power to ascend as level tracks.

When you consider the increased range of speed regulation afforded by the regenerative system, the ease of starting stopping or retarding on grades without the aid of such mechanical monstrosities as friction brakes, and add to them the economy over ordinary methods, it seems that the ordinary controllers now used on cars and on automobiles are destined to the "scrap heap."

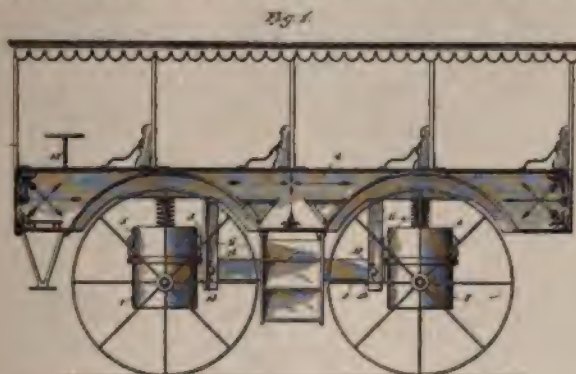
MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 624,319—Motor Vehicle—Joseph M. Forbes, Croman-
ton, Fla. Application filed June 28, 1897.

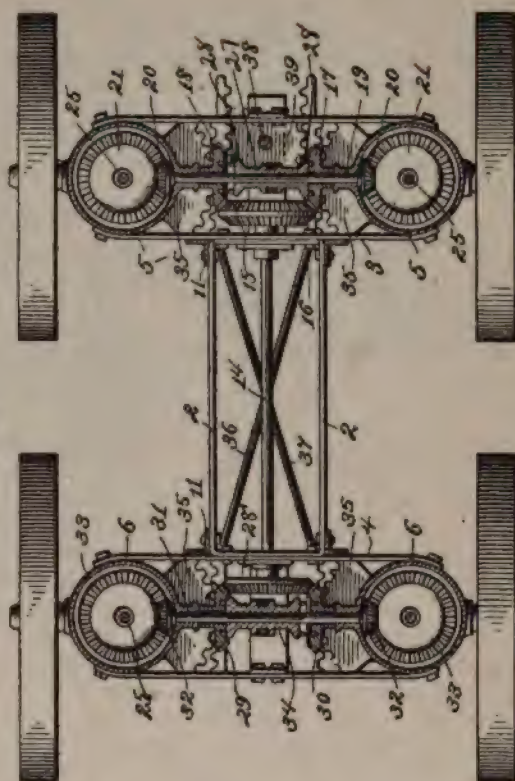
The numeral 1 designates the body of the vehicle; 2 designates the longitudinal reach-bars of the running-gear, which are rigidly connected to the front and rear hounds 3 and 4, the said hounds being secured at their ends to cylindrical casings 5 and 6, respectively, said casings being mounted upon similar casings 7 and 8, mounted upon the front and rear axles of the ground-wheels. The bearing-surfaces of the upper and lower casings are constructed to receive antifriction-rollers 9, and the stub-axles of the ground-wheels pass into said casings and are journaled in ball-bearings formed therein. By this construction the ground-wheels will be permitted to have independent movement with respect to the running-gear, the body of the vehicle being mounted upon said running-gear, so as to have the ordinary rocking or spring movement thereon. Any style of spring may be interposed between the body and running-gear, and when the ordinary coil-spring is employed the casings 5 and 6 are provided centrally with uprights 10, as shown in the drawings; but it will



be understood that the ordinary elliptical springs may be used and their ends rest in suitable clips attached to the said casings. The body of the vehicle is further connected to the running-gear by depending corner-brackets 11, which fit at the intersection of the reach-bars 2 and hounds 3 and 4, these parts being connected by bolt and nut 12, which passes through a slot 13 in the bracket 11, or said slot may be located in the running-gear instead, this permitting spring movement of the body with respect to the running-gear.

14 designates the main shaft of the driving mechanism, which extends at the center of the vehicle between the hounds 3 and 4, upon which it is journaled by any approved antifriction-bearing. This shaft extends beyond the hounds at each end, and at its forward end has mounted thereon a gear-wheel having bevel-teeth 15 and 16, the teeth 15 engaging bevel-wheels 17 and 18, mounted on a transverse shaft 19, bearing at its ends in the upper casings 5 at the forward end of the vehicle. The shaft 19 is provided at its ends with bevel-

Fig. 2.

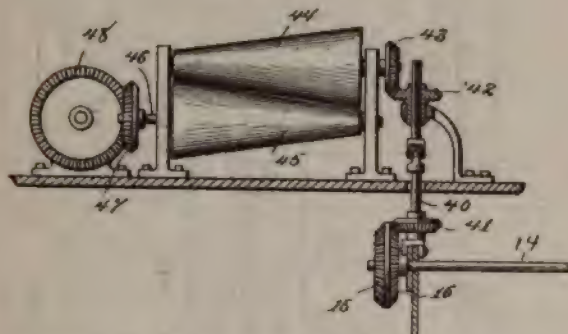


pinions 20, located within the casings 5, and these bevel-pinions engage the upper teeth of a double bevel-wheel 21, mounted horizontally in the casings 5, the lower teeth of said bevel-wheels meshing with bevel-pinions 22 on the stub-axles 23 of the front supporting-wheels. The preferred manner of supporting the horizontal bevel-wheels 21 is shown in the accompanying drawings, in which the cover of each casing 5 is provided with a depending boss 24, having a central threaded recess to receive a spindle 25, a lateral pin or set-screw 26 holding the said spindle against rotation. The head of this spindle and adjoining bearing-surface of the bevel-wheel may be provided with cones to form bearings for interposed balls. By gearing the main driving-shaft 14 to the axles of the supporting-wheels in the manner hereinbefore described the said supporting-wheels will be driven forward or backward, according to which bevel-wheels 17 and 18 are in mesh with the teeth 15 of the bevel gear-wheel mounted on said driving-shaft, and in order to throw the shaft 19 in engagement with either one of the bevel-wheels 17 and 18 the said shaft is provided between said bevel-wheels with a sleeve 27, in sliding engagement with the shaft by the ordinary groove and spline, the ends of said sleeve having clutch-sections 28, adapted to engage clutch-faces formed on the said bevel-wheels. This sleeve is connected to an ordinary lever within reach of the driver or motorman, by which the sleeve can be shifted to engage one or the other of the bevel-wheels 17 and 18, or to an intermediate point to let the driving-wheels run free. It will also be noted that by gearing the shaft 19 to the horizontal bevel-wheels 21 and said bevel-wheels to the pinions on the stub-axles the supporting-wheels will be allowed to turn, and in so doing the said pinions will ride upon the said bevel-wheels.

The rear end of the main driving-shaft 14 has mounted thereon a bevel-wheel 28', which meshes with the bevel-wheels

29 and 30 on a transverse shaft 31, corresponding with the shaft 19 hereinbefore referred to and bearing in the upper casings 6 at the rear end of the vehicle. The ends of this shaft 31 are provided with bevel-pinions 32, in mesh with a horizon-

Fig. 7.



tally-disposed double bevel-wheel 33, the latter meshing with pinions on the stub-axes of the rear supporting-wheels, said stub-axes bearing in the casings 8. The shaft 31 is also provided with a sleeve 34, interposed between the gear-wheels 29 and 30 and having clutch-sections to engage said wheels, and this latter clutch mechanism is connected to the means which operate the clutch at the forward part of the machine so that they will both be shifted in unison.

The supporting-wheels of the vehicle will be permitted to have an independent movement with respect to the running-gear by reason of the two-part casings turning one upon the other, and in order to turn the casings simultaneously in the operation of steering or turning the vehicle each lower casing is provided with a segment-rack 35. The segment-racks extending from the casings at one end of the vehicle are connected to the segment-racks at the other end by rods 36 and 37, each rod connecting a casing or wheel on the other side and at the opposite end. At the forward end of the vehicle to have a bearing in the running-gear is a vertical shaft 38, upon the lower end of which is mounted a gear-wheel 39, in mesh with the rack-bars on the ends of the rods 36 and 37, as shown in detail in Fig. 8, the said rack-bars in turn meshing with the segment-racks attached to the movable casings of the forward supporting-wheels. The upper end of the shaft 38 has a hand-wheel located in front of the driver, by which the said gear-wheel is turned to move the wheels with respect to the running-gear in making a turn. By this arrangement the turning of the hand-wheel in one direction will turn the forward wheels to guide the vehicle either to the right or to the left, and by means of the connecting-rods 36 and 37 the rear supporting-wheels will also be moved to assist in the turn, the last-mentioned wheels being turned at an angle with respect to the forward wheels.

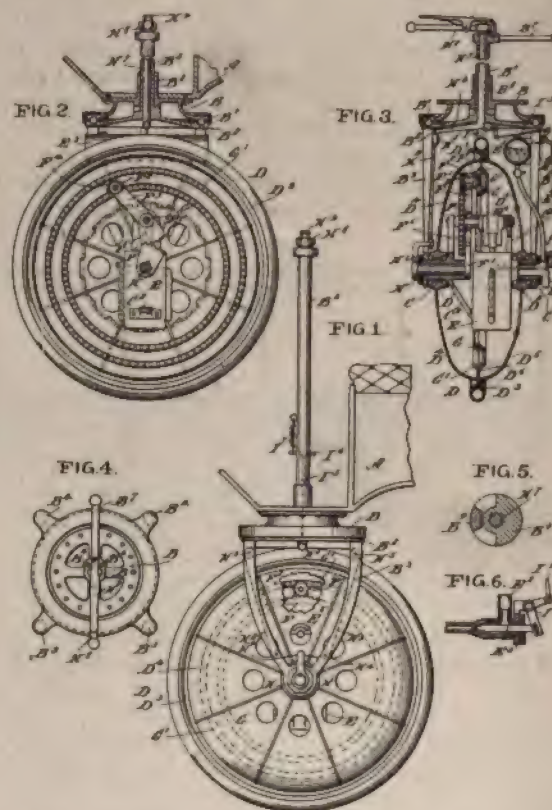
In Fig. 7 is shown the manner of connecting the engine to the main shaft, which consists in providing a vertical shaft 40, having a pinion 41 in mesh with the teeth 16 of the double bevel-wheel on said shaft 14, and the upper end of this vertical shaft 40 passes through a pinion 42, suitably supported and geared to the pinion 43, projecting from a shaft of a conical friction-wheel 44. The conical friction-wheel 44 is adapted to be thrown in contact with a similar wheel 45 on a shaft 46, having a bevel-wheel 47, driven by the motor. Two motors are preferred and in Fig. 7 the wheel 47 is shown to be a bevel-wheel, and the wheel 48 shows the manner of connecting one of the engines thereto.

By providing the vertical shaft 40 so that it will be slid through the pinion 42 any vertical movement of the body of the vehicle upon the running-gear will not interfere with the proper gearing of the engine with the driving-shaft 14, and in order to permit the body of the vehicle to have a rocking movement on the springs the shaft 40 has a knuckle-joint.

No. 624,414—Motor-Wheel for Vehicles—Julius William Walters, New York, N. Y. Application filed Dec. 21, 1898.

Fig. 1 is a side elevation of the improvement, with part in section and arranged as the front driving-wheel of a vehicle. Fig. 2 is a sectional side elevation of the same. Fig. 3 is a transverse section of the same. Fig. 4 is a plan view of part of the improvement. Fig. 5 is an enlarged sectional plan view of the stop of the steering device. Fig. 6 is an enlarged sectional side elevation of the cut-off valve for the engine. Fig. 7 is a plan view of the improvement, as applied to two connected wheels. Fig. 8 is a front elevation of the same.

The motor-wheel illustrated in Figs. 1 to 6, inclusive, is applied to a vehicle A, having two hind wheels and one front wheel, of which the latter is the driving-wheel, and is provided with the improvement for rotating said wheel to propel the vehicle A forward or backward and for steering the vehicle.

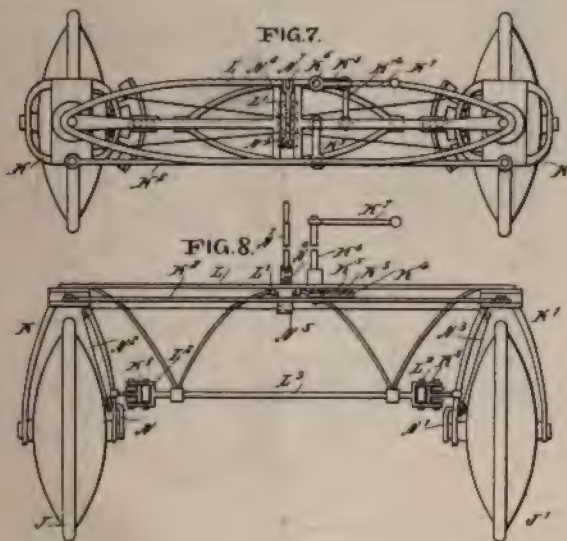


The body of the vehicle A is provided at its front end with a bearing-plate B, engaging ball-bearings B1 on a plate B2, having downwardly-extending fork-arms B3 B4, supporting alined sleeves C C1, respectively, on which are mounted to turn by ball-bearings the alined hubs D1 D2 of a wheel D, the rim D3 of which is connected by outwardly-curved webs D4 D5 with the said alined hubs D1 D2, respectively.

Within the two webs D4 D5 is arranged a motor E, preferably in the form of a gas or gasoline engine, having an air-supply pipe E1 and a gas-supply pipe E2, connected with a

reservoir E3, attached to the fork-arm B4 and containing the motive agent to be used in the motor E. A stop-cock E4 is arranged in the pipe E2 for cutting off the supply of motive agent when the vehicle is not in use, and a valve E5 (see Fig. 6) is employed and is under the control of the operator for controlling the supply of motive agent to the motor. The frame of the motor E is supported by suitable brackets C2 from the sleeves C C1, and the main shaft E6 of said motor carries a gear-wheel F in mesh with a pinion F1, secured on a short shaft F2, journaled in an arm F3, mounted to turn loosely on the main shaft E6. On the shaft F2 is also secured a bevel gear-wheel F4, adapted to be thrown in mesh with either of the bevel gear-wheels G or G1, carried by a suitable web D6, forming part of the vehicle-wheel D. (See Fig. 3.)

The arm F3 is provided with a segmental gear-wheel F5 in mesh with a segmental gear-wheel F6, secured on a shaft H, mounted to turn loosely in the sleeve C, the outer end of the shaft carrying an upwardly-extending arm H1, connected with two ropes or cables H2 H3, extending in opposite directions and passing over friction-rollers H4, journaled on the fork-arms B3. The ropes or cables H2 or H3 then extend upward and pass over friction-rollers H5 to then connect with an arm H6, secured on the lower end of a shaft H7, mounted to turn in the hub B5 of the headplate B2, as is plainly illustrated in the drawings.



On the upper end of the shaft H7 is arranged a handle H3 under the control of the operator and provided with a locking-lever H9, adapted to engage one of a series of notches B6, formed on the upper end of the hub B5, to lock said handle H8 in any of three positions. When the locking-lever H9 engages the middle notch B6, as indicated in Fig. 4, then the bevel gear-wheel F4 is out of mesh with either of the two gear-wheels G or G1; but when the lever H9 is thrown out of engagement with the notch B6 and the handle H8 is then turned either to the right or to the left then a pull is exerted by the arm H6 on either the ropes or cables H2 or H3 to impart a swinging motion to the arm H1 and a turning motion to the shaft H, so that the segmental gear-wheel F6 imparts a swinging motion to the segmental gear-wheel F5 of the arm F3 to swing the bevel gear-wheel F4 in mesh with the gear-wheel G or G1, according to the direction in which the handle H8 was turned.

As shown in Fig. 2 the bevel gear-wheel F4 is in mesh with

the inner or smaller gear-wheel G, and when the handle H8 is swung into an opposite working position then the bevel gear-wheel F4 is thrown in mesh with the gear-wheel F1 and a reverse motion is given to the wheel D. It is understood that the rotary motion given to the motor E, shaft E6, and gear-wheel F is at all times transmitted by the pinion F1 to the shaft F2, so that the gear-wheel F4 rotates the wheel D in either a forward or backward direction, according to the position of the arm F3.

On the upper end of the hub B5 is secured a steering-handle B7, extending in an opposite direction to the handle H8, and is likewise under the control of the operator. The hub B5 is further provided with two shoulders, as indicated in Fig. 5, for abutting against a lug B9, depending from the hub B8, for the plate B, so as to limit the turning motion given to the said hub B5 by the operator manipulating the handle B7. It is understood that when the operator swings the handle B7 forward or backward a turning motion is imparted to the hub B5, and consequently to the plate B2, mounted to turn on the ball-bearings B1 and carrying the wheel D by the fork-arms B3 B4 and the sleeves C C1. By the arrangement described the vehicle-wheel is steered in the desired direction.

The valve E5, for controlling the supply of motive agent to the engine, is under the control of the operator's foot, and for this purpose the stem of the valve E5 is connected with a bell-crank lever I, connected by a link I1 with a bell-crank lever I2, fulcrumed on the fork-arm E4 and connected by a link I3 with another bell-crank lever I4, fulcrumed on the under side of the bearing-plate B2. The bell-crank lever I4 carries an upwardly-extending rod I5, provided with a cross-arm I6, adapted to be engaged by the operator's foot to enable the operator to press the arm I6 downward to impart a swinging motion to the bell-crank lever I4 and by the links I3 I1 and bell-crank lever I2 I a sliding motion to the valve E5 to open or close the passage leading from the pipe E2 to the combustion-chamber of the engine. When the operator releases the pressure on the cross-arm I6, a spring I7 draws the cross-arm and connected parts back to their former position to move the valve E5 open for further admission of the motive agent.

In the modified form shown in Figs. 7 and 8, two motor-wheels J J1 are employed, similar to the motor-wheel D, their fork-arms K K1 being mounted to turn in the outer ends of a bolster L, forming part of the vehicle. The fork-arms K K1 are pivotally connected with each other forward of their king-bolt by a link K2, connected with a bell-crank lever K3, connected by a link K4 with an arm K5 on the lower end of a shaft or staff K6, mounted to turn in suitable bearings in the bolster L, the upper end of the staff carrying a handle K7 under the control of the operator for steering the vehicle in the desired direction. When the arm K7 is moved forward or backward, movement is given to the staff K6 and by the arms K5 and link K4 to the bell-crank lever K3, which pushes the link K2 to the right or to the left to turn the fork-arms K or K1 correspondingly and simultaneously and give the desired direction to the motor-wheels.

In order to insure an easy turning of the fork-arms K K1, I provide the same with inwardly-extending segments K8 engaged by rollers L2 on the ends of a frame L3, carried by the bolster L, as is plainly indicated in the drawings.

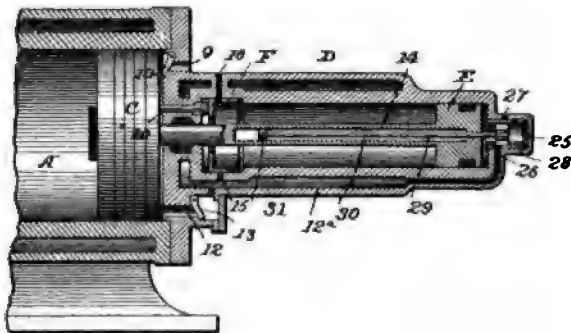
In order to control the connecting mechanisms between the motors and the wheels, I provide arms N N1, which correspond to the arm H1 in Fig. 3, with cords N2 N3, having pulleys N4 mounted to turn in a slide N5, fitted to move

longitudinally in a guideway L1, carried by the bolster L. The slide N5 is connected by a link N6 with an upwardly-extending lever N7, fulcrumed on the bolster L and under the control of the operator. When the lever N7 stands in a vertical position, then the bevel gear-wheels F4 of both motor-wheels are out of mesh with the driving gear-wheels G G1, and consequently no rotary motions are transmitted from the engines to the wheels; but when the lever N7 is moved forward or backward then the cords are simultaneously actuated to impart swinging motions to the arms N N1 and swing the gear-wheels F4 in mesh with either of the bevel gear-wheels G or G1 to turn the wheels forward or backward to propel the vehicle in a corresponding direction.

From the foregoing it is understood that the motor-wheel for vehicles carries the motor in the wheel proper, and the power developed by the motor is directly transmitted to the wheel, and consequently undue loss of power is completely avoided, and at the same time the driving and steering wheel for the vehicle is completely under the control of the operator.

No. 623,980.—Automatic Explosive Compression Engine.—Franz Burger, Fort Wayne, Ind., assignor of three-fourths to Henry M. Williams, same place. Application filed March 2, 1898.

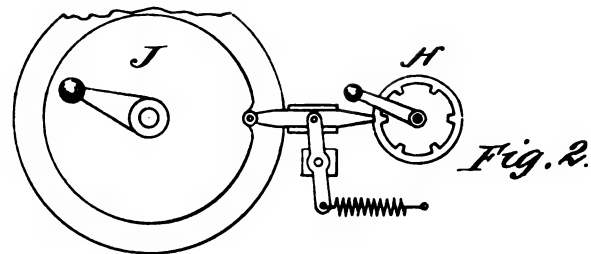
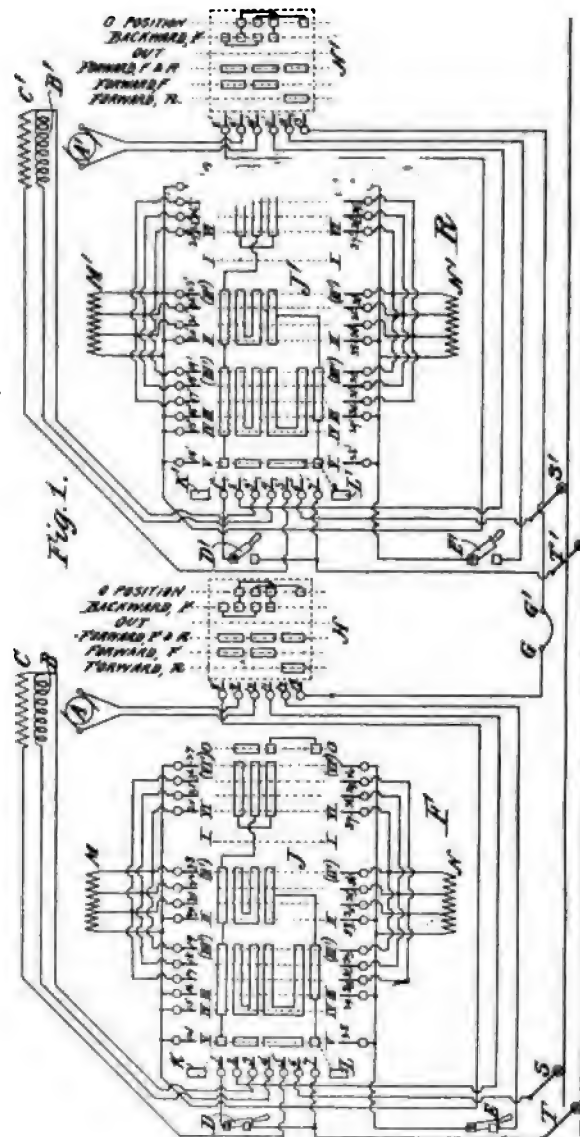
This invention relates to certain new and useful improvements in apparatus by means of which exploded gas, or hydrocarbon mixed with air, in a highly-compressed state, may be stored up in a suitable reservoir to be subsequently utilized as a motive power for driving various forms of engines.



Claim.—The combination of a main and an auxiliary cylinder arranged in line and having connected pistons, an inlet for an explosive charge and a valve-controlled discharge-opening at one end of the main cylinder, a valve-controlled discharge-opening for compressed air at the opposite end of said cylinder, an inlet and an exhaust port at one end of the auxiliary cylinder, the inlet-port communicating with the compressed-air-discharge port of the main cylinder, a slide-valve for controlling the inlet and exhaust ports of the auxiliary cylinder, said valve being arranged to be moved in one direction by the piston of one cylinder and in the opposite direction by the piston of the other cylinder.

No. 624,250—Controller for Electrically Propelled Vehicles—Emil Berthold Walter Reichel, of Berlin, Germany, assignor to the Siemens & Halske Electric Co. of America, of Chicago, Ill.

Claim.—The combination with a plurality of electric motors mounted upon and propelling different cars of a train, of a conductor extending between and adapted to unite the said motors, and controllers also provided upon the different cars and associated each to each with the said motors comprising

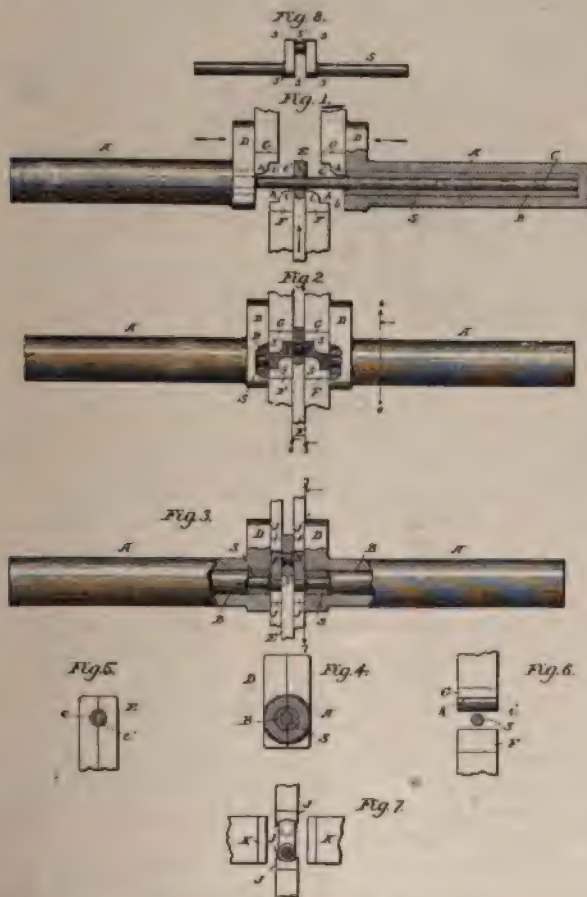


resistances, stationary and movable contact parts for effecting the connection of the several motors in series and parallel arrangement, said contacts being disposed to secure the flow of current through different branches in the controller when the motors or groups of motors are connected in parallel, and additional switching mechanism for effecting the control the motors by means of a given controller, or for controlling the corresponding motor for regulation through an additional controller.

No. 624,619.—Apparatus for Making Crank Shafts. John P. Harrington, Baltimore, Md. Application filed January 8, 1898.

The class of crank-shafts to which the invention relates comprises those having two cranks at some intermediate point on the crank-shaft and a common crank-pin.

A A indicate a pair of sockets which receive the ends of the shaft S, upon which the cranks are formed. The sockets have cylindrical openings equal to the diameter of the largest shafts for which the apparatus is adapted, and for smaller shafts cylindrical bushings B are used. Within the bushings are filling-blocks C, which form solid abutments for the ends of the shafts S. By varying the bushings and filling-blocks the sockets may be adapted to hold shafts of any diameter or length smaller than the maximum capacity of the sockets. On the inner ends of these socket-pieces are the main dies D. The bushings and the dies D are preferably formed in halves which are separable to permit the ready insertion and removal of the shaft, the line of division being vertical, as shown in Fig. 4. This feature, however, is not absolutely essential, as the shaft may be inserted and withdrawn by the endwise movement of the parts without separating them. Suitable means for operating the sockets and dies D are provided, such as pressure pistons or cams. The inner faces of the dies D are flat and parallel, and are used to shape the outside faces of the cranks.



The crank-pin is formed by a central die E, which is moved at right angles to the movement of the dies D. This die E is preferably divided vertically, as shown in Fig. 5.

It has a central opening *e*, through which the shaft passes, as shown in Fig. 1, and which determines the size of the crank-pin. This opening is preferably rabbeted at *e'* to form annular shoulders at the ends of the crank-pin, as shown in Fig. 8. The dies D are similarly rabbeted at *b* to form annular shoulders on the shaft adjoining the cranks. These shoulders strengthen the connections between the cranks and the shaft and crank-pin.

Adjacent to the die E are a pair of dies F, which cooperate with a similar pair of dies G, adjacent to the dies D, to give the crank its preliminary shape, as shown in Fig. 2. These dies are formed with right-angled recesses *h*, into which the metal is upset to form the angles *s* of the cranks. They are also provided with rounding shoulders *i*, which perform the preliminary bending of the blank, as illustrated in Fig. 2.

The shaft is suitably heated and the ends are fitted into the sockets A, and the die F is closed upon the portion which is to form the crank-pin, as shown in Fig. 1, the dies F and G occupying the positions shown in that figure. To perform the first step in the process, the shanks A and the dies D and G are moved toward each other, and simultaneously the die E and the dies F are moved vertically. The dies G are prevented from vertical movement, and in consequence the parts assume the position as shown in Fig. 2. During this operation the metal is upset into the angles *h*, and the corners *s* of the cranks are formed. At the same time the cranks are turned up to an angle of about forty-five degrees with the shaft, and the metal is upset sufficiently to form the shoulders *s'* adjacent to the cranks. The dies F and G are now withdrawn, and two pairs of dies J, equal in thickness to the cranks and having curved faces *j*, are substituted. These dies have a reciprocating movement, and they form the rounded ends of the cranks. Upon the sides of each crank, as shown in Fig. 7, are a pair of dies K, equal in thickness to the cranks and adapted to form the edges thereof. The dies K have a reciprocating movement, and they strike the cranks alternately with the dies J.

The second operation in forming the cranks consists in removing the dies F and G and then giving the die E a further movement until the crank-pin is brought to its proper position and at the same time moving inward the dies D to bring the shaft ends into proper relation with the cranks and to turn the cranks at right angles to the shaft. This brings the dies D and E into the position shown in Fig. 3, and while they are held in this position the third operation, which consists in hammering or pressing the edges and ends of the cranks into shape, is performed by the alternately-reciprocating dies J and K.

All of the above operations may be completed in a very brief space of time, so that a crank-shaft may be finished with a single heating of the blank. The angles of the cranks are formed perfectly and there is a minimum disturbance of the grain or fiber of the metal. The angles of the cranks are perfect and the junctions of the cranks with the pin and shaft are very strong.

No. 624,017.—Change Driving Gear—Frank George Hampson, Shoreham, England. Application filed Oct. 31, 1898.

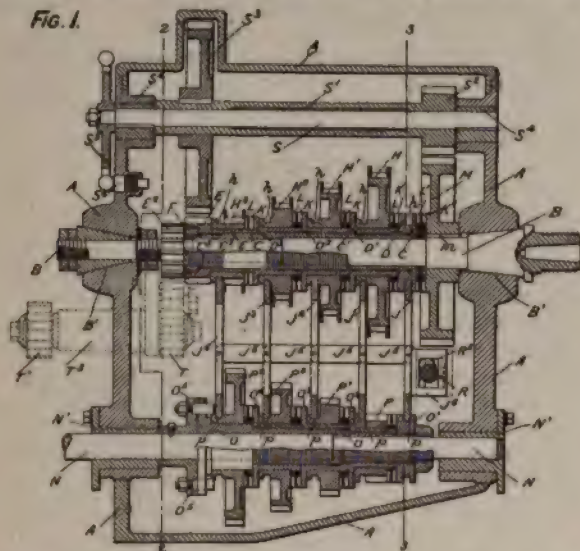
This invention is said to be applicable to self-propelled vehicles, but is described as applied to a lathe.

A is a frame or casing serving to support and partly inclose the various parts which constitute the head-stock.

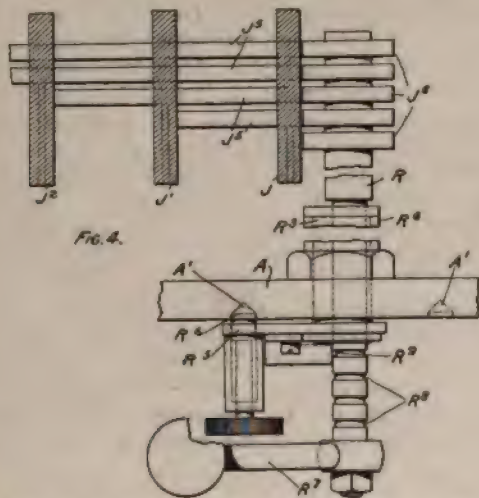
B is a spindle forming the usual mandrel of the lathe. It is supported in coned bearings B₁ in the case A. Upon the mandrel B and free to rotate and slide upon it is a sleeve

C, screwed as at C₁, C₂, C₃. Four flanged sleeves D, D₁, D₂, D₃ are screwed upon the portion C₁ of the sleeve C, and a spur-wheel E, having an extension in the form of a sleeve E₁, is screwed upon the portion C₂. A locknut F upon the

FIG. 1.



screwed part C₃ of the sleeve C serves to prevent the spur-wheel E from becoming unscrewed. The thread in the spur-wheel E is left-handed. A gear-wheel E₂ is also provided, mounted directly upon the mandrel B. Four chain wheels or gears H, H₁, H₂, and H₃ are mounted free to rotate and to move longitudinally upon the sleeves D₁, D₂, D₃, and E₁, respectively, and the boss of each of these gears H, H₁, H₂, and H₃ is furnished with a recess, as at *h*, to accommodate one of a series of clutch-levers J₁, J₂, J₃, and J₄. A similar recess is formed upon the sleeve D to receive a clutch-lever J.



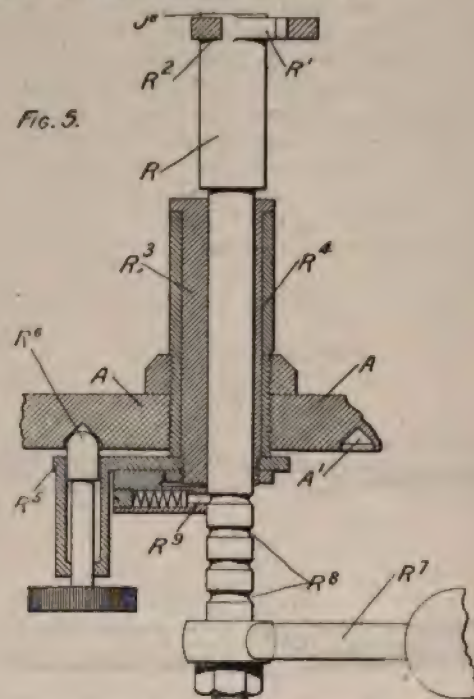
Upon the left-hand side of each of the sleeves D, D₁, D₂, and D₃ a series of projections or teeth K is provided and upon the right-hand sides of the gears H, H₁, H₂, and H₃ are similar projections L. The adjacent sets of projections L K form clutches, by means of which any one of the gears H, H₁, H₂, H₃, may be engaged with its corresponding sleeve, and consequently to the main sleeve C.

In order that when desired the sleeve C may be operatively connected with the mandrel B, it is provided with a set of pro-

jections L₁, which co-operate with a corresponding set K₁ to form a clutch similar to the clutches L K. The projections K₁ are formed upon the side of a toothed wheel M, which forms one of the wheels of the back gear and is keyed, as at *m*, to the mandrel B.

N is a countershaft supported in oil-tight eccentric bearings N₁ in the case A. It is provided with a sleeve O, carrying a series of sleeves O₁, O₂, O₃, and O₄ and chain-wheels or gears P, P₁, P₂, and P₃, which are arranged with clutches in a manner substantially the same as described with reference to the mandrel B. The sleeve O is capable of longitudinal motion upon the shaft N, but always rotates with it through the action of a coupling O₅. The bosses of the chain-wheels P, P₁, P₂, P₃ are recessed, as at *p*, to accommodate the other ends of the clutch-levers J₁, J₂, J₃, J₄, and the sleeve O₁ has a similar recess to receive the clutch-lever J.

FIG. 5.



The countershaft N is driven in any desired manner from the source of power.

Each of the gears upon the countershaft N is opposite to one of the gears upon the mandrel B and is geared to it by a driving-chain, as at Q, Fig. 2. The recesses *h* and *p* in the bosses of each pair of gears receive opposite ends of one of the clutch-rods J₁, J₂, J₃, or J₄, and the sleeves C and O are connected in a similar manner by means of the rod J, the ends of which enter the recesses *h* and *p* in the screwed sleeves D and O₁, respectively.

Each of the clutch-rods J, J₁, J₂, J₃, J₄ is provided with an arm J₅, which terminates in a box or frame J₆. Each arm J₅ is connected only to its own particular clutch-lever and passes freely through slots or openings in the others—e. g., the arm J₅, which is connected to the clutch-rod J₂, Fig. 4, passes freely through the clutch-rods J and J₁.

Through the interior of the frames J₆ a shaft R passes, having a projection or cam R₁ upon it. A recess R₂ is formed in the shaft R opposite to the cam R₁.

The shaft R is mounted eccentrically in a bush R₃, Figs. 5 and 6, which is carried in a bearing R₄ in the side wall of the case A. A handle R₅, with a spring-controlled stop R₆, is

attached to the bush R3, and two hollows A1 are formed in the case A to receive the stop R6, so that by turning the handle R5 the shaft R may be caused to move bodily in a lateral direction in the case A, and by means of the stop R6 and the hollows A1 may be fixed in either of its extreme positions. The horizontal dimension of the interior of the frames J6 is approximately equal to the diameter of the shaft R, so that the lateral movement of the shaft causes a corresponding movement of the arms J5, which accordingly move their respective clutch-rods J1, J2, J3, J4. The effect of this is to cause the sleeve C to engage or disengage with the mandrel B by means of the clutch L1 K1 and to move the sleeve Q longitudinally upon the countershaft N. This occurs, however, without altering the relative positions of the gears and clutches.

The shaft R is capable of longitudinal motion in the bush R3. This is necessary in order to bring the cam R1 in line with any one of the frames J6. A handle R7 is provided in order that the shaft may be moved in the bush R3, and grooves R8 are turned in the shaft in such a position that when a spring-catch R9 is in engagement with one of the grooves R8 the cam R1 is inside one of the frames J6. As illustrated in Fig. 4, the shaft R is withdrawn as far as possible and the cam is inside the frame J6, which operates the clutch-rod J1. The cam R1 never enters the first frame J6—i. e., that one connected to the clutch-rod J—because that clutch-rod is never required to move by itself relatively to the other clutch-levers, and is therefore only operated by the lateral movement of the shaft R.

The bearings N1 of the countershaft N being made oil-tight, oil may be placed in the lower portion of the case A, so that the driving-chains Q are constantly lubricated.

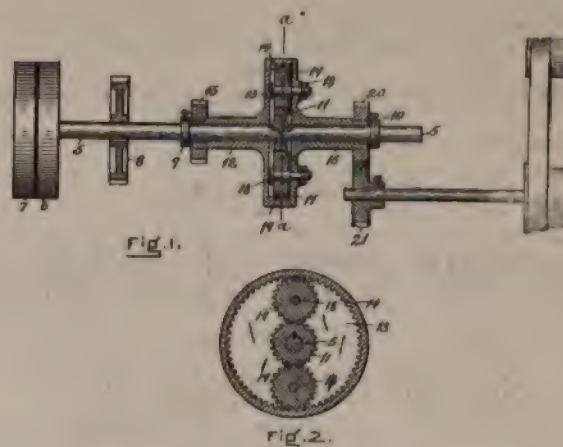
The arrangement of back gear is as follows: A sleeve S1, Fig. 1, carries two gear-wheels S2 and S3, which engage with the gear-wheels M and E, respectively, in a manner similar to the usual arrangement of back gear. The sleeve S1 rotates upon a spindle S, which is carried in eccentrics S4 in the case A, and is provided with a handle S5, and a spring-socket S6 in order that the gear-wheels S2 and S3 may be readily placed in or out of engagement with the wheels M and E and kept in the desired position.

Gear-wheels for screw-cutting are shown attached to the improved head-stock in Figs. 1, 2 and 7. Two gear-wheels T and T1 are mounted at opposite ends of a shaft T2, carried in a bearing T3 in the case A. A triangular plate U is pivoted around the shaft T2 and carries two gear-wheels U1 and U2. This plate U is controlled by a lever W, which slides in the case A, as at W1. By sliding the lever W in or out the plate U is turned upon the shaft T2, so that (a) neither of the wheels U1 or U2 engage with the wheel E2; (b) the wheel U1 engages with the wheel E2, and drives the wheel T in one direction, or (c) the wheel U2 gears with the wheel E2 and drives the wheel U1 and through it the wheel T in the other direction. The motion of the wheel T is transmitted through the shaft T2 to the wheel T1, which by means of wheels T3 and T4 drives the leading-screw X. The lever W may be held in either of the three positions by means of the holes W2 and the pin W3.

Any slackness due to wear or stretch in the driving-chains may be taken up by turning the eccentric-bearings N1, in which the countershaft N is carried.

No. 624,186—Differential Gear—Richard F. Daly, Woodstock, R. I. Application filed August 16, 1898.

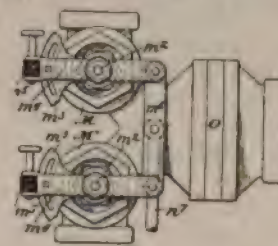
Claim—The combination with the shaft 5, and the gears 8



and 11 fixed thereon, of the sleeve 12 journaled on the shaft between said gears and having the casing 13 with the internal gear 14, and the gear 15 fixed on said sleeve, the sleeve 16 journaled on the shaft 5 at the opposite side of the gear 11 and having the plate 17, the shafts 18 18 secured in said plate, the gears 19 19 journaled on said shafts and intermeshing with the gear 11 and with the internal gear 14, and the gear 20 fixed on the outer end of the sleeve 16, as herein shown and described.

623,567—Speed Regulator for Explosive Engines—John A. Secor, New York, N. Y. Filed Oct. 7, 1897. Serial No. 654,349.

Claim.—In an explosive engine, the combination of independent, rotary oscillating valves for admission of hydrocarbon and air separately, toothed sectors secured to the stems of



said valves respectively, arms mounted loosely on said stems respectively, worms carried by said arms to engage said sectors respectively, a link connecting said arms to move together, a governor and a connection therefrom to said link, whereby said valves are oscillated together by the governor and are separately adjustable about the axis of oscillation to vary the relative proportions of hydrocarbon and air.

623,821—Electrically Controlled Valve Gear for Gas or Other Motors—David W. Payne, Elmira, N. Y. Filed March 25, 1898. Serial No. 675,144. (No model.)

No. 624,372—Burner for Hydrocarbon Liquids—Harrison Ogborn, Indianapolis, Ind. Application filed Aug. 1, 1898.

Fate stood at the door.

"Messieurs," she announced, "the man on horseback!"

The French merely smiled, affably, to be sure, and proceeded with their crisis.

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It will open with very readable articles on the general subject of the Bicycle and the Automobile. It is not generally known that the automobile is older than the locomotive; but in this special number one or two forms of the horseless carriages that were in use early in this century will be illustrated and described.

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VOLUME 4

MAY 17, 1899

NUMBER 7

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Interest of the
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ESTABLISHED 1895.

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American Tract Society Building, Nassau and Spruce Streets,
NEW YORK.

**Professor Herring's Bicycle and Flying Machine Motors,
page 7.**

American Motors and Cycles at the Paris Exposition.

The relative importance of the bicycle and the motor vehicle industries in the estimation of Commissioner Peck, representing the interests of the United States at the coming Paris Exposition, is seen in the size of the spaces allotted to these two industries. Although the bicycle industry is fully developed here, and its ramifications are now world wide, less space has been given to it than has been reserved for our motor vehicle exhibits, and the motor industry is perhaps the youngest of all our infant industries.

The commissioner judged wisely. Before the Paris Exposition opens the new industry will have made tremendous strides here and a better showing than now seems possible can be made. Again, mechanically and commercially considered, the motor vehicle industry far surpasses its precursor. Its relative backwardness and brilliant future here amply justify the prominence which has been given to it by the commissioner in the allotment of space.

Motor Vehicle Insurance.

One of the New York insurance companies has undertaken a new line of business. It insures owners of motor vehicles against loss by litigation for the period of one year for the sum of \$15. The company is said to have gone pretty thoroughly into the subject and has no doubt allowed a liberal margin for profit. Then the motor vehicle is not such a bull in a china shop after all.

Those Compressed Air Trucks.

New Yorkers have been waiting patiently for the compressed air trucks, which we were told would be relieving the draft horse of his burdens long before this. Though no trucks are yet visible to the naked eye, we are informed that two of them are receiving final tests at the Worcester shops of the company, and may be expected soon. The promotor is always a long way ahead of the mechanic because things are easier said than done. However, let us hope that our curiosity will be satisfied at an early day, and our knowledge of motive powers augmented by some actual working data of compressed air motor trucks.

Sheet Metal Bodies.

Sheet metal is being quite extensively used for motor vehicle bodies abroad, and some of our own constructors are experimenting with it. In some kinds of vehicles the objection is raised that the sheet metal makes too much noise on rough roads. This is undoubtedly true, but is it not possible to employ some kind of packing in the joints which shall go far to remedy this?

The Electrical Exhibition.

Since the Electrical Exhibition opened new vehicles which could not be finished in time for the opening have been added one by one, until now about thirty are to be seen. They are all fine examples of the engineer's and the carriage builder's works, and are certainly worthy of the closest study by all interested in motor vehicles. The variety of vehicles shown is wide, embracing most of the popular types, from the light runabout to the truck. No such exhibition of electric vehicles could be made in Europe, as this particular branch of the industry has not yet reached our own development there. nor is it likely to, for the electrical industry of the United States is undoubtedly further advanced than that of any foreign country. Considering the brief space of two or three years they have had to grapple with the difficulties of road locomotion our electrical engineers certainly make a very commendable showing.

Limiting Speed.

The city fathers of Cleveland, O., have finally taken action on the matter of regulating the speed of motor vehicles. They have directed the superintendent of police to enforce the ordinance regarding the speed of vehicles in the streets. Similar ordinances may be looked for from other municipal authorities. Even in Paris, hotbed of enthusiasm that it is, the excessive speeds that have been fostered by road racing are beginning to be frowned down, and the rational side of the motor vehicle is coming to the front. Let enthusiasm be tempered by judgment at the outset in America, and much unnecessary friction will be avoided.

Professor Herring's Light Motors.

We wish to call particular attention to the article in the following pages on Professor A. M. Herring's latest bicycle and flying machine motors. Professor Herring has probably had as much experience as any man in this country in the construction of light motors of all kinds, as he has been for years endeavoring to find one which would solve the problem of aerial locomotion. We hope in the near future to give complete details of these marvelously light and efficient little machines.

Large Order for Motor Trucks.

The Graham Equipment Co., of 170 Summer street, Boston, Mass., report that they have an order from the National Transportation Co., of the same city, for 135 motor trucks, to be used under the steam 'buses which the latter company is to introduce in Boston and vicinity.

These trucks will be built with steel frames, and will be equipped with "Graham's Spring Suspension and Equalized Brakes," which is said to be the only device which will obviate the use of rubber tires on heavy vehicles, and yet permit a high rate of speed over city pavements without jar or inconvenience to the passengers, or damage to the motive power.

Professor Herring's Flying Machines and Bicycle Motors.

Professor A. M. Herring, the well-known investigator of the art of flying, whose aeroplanes and motor were described in our issue of May, 1897, has been steadily engaged ever since in perfecting his apparatus, and now announces that he has constructed the first self-propelled flying machine to successfully carry an operator in free flight. The power employed is compressed air. Professor Herring has just concluded a series of most satisfactory experiments at St. Joseph, Mich. The flying machine in its latest form weighs eighty-six pounds complete, and consists of two long surfaces or aerocurves, which resemble broad, shallow gutters turned upside down and spaced one above the other about a yard apart. These surfaces in themselves are marvels of construction. They are of the thinnest China silk, stretched over very light curved wooden ribs, and varnished with a transparent shrinking varnish, which stretches the silk without a single wrinkle, to the tightness of a drum head. These surfaces are then trussed together, one above and one below, by a number of upright posts. Then diagonal steel wires make the machine resemble a miniature bridge, which by its extreme rigidity and lightness shows the highest skill of the mechanical engineer.

Just above the lower surface of this is a small two-cylinder motor, weighing perhaps a dozen pounds, but which, if necessary, can develop four or five horse-power. This motor turns two five-foot propellers, set parallel and situated one at the front and one at the rear of the machine. Below the motor is a small tank six or seven inches in diameter and about two feet long. This is filled with compressed air, 884 cubic

inches at 600 pounds pressure to the square inch, furnishing power to the motor. Even with the tank, about twenty inches below the bottom surface, are two small horizontal bars which in flight carry the operator's weight. Further out on each side and extending still farther down are four small upright posts which support the machine on skids. At the back of the whole machine are two surfaces intersecting at right angles and joined to the main apparatus through an automatic regulative mechanism.

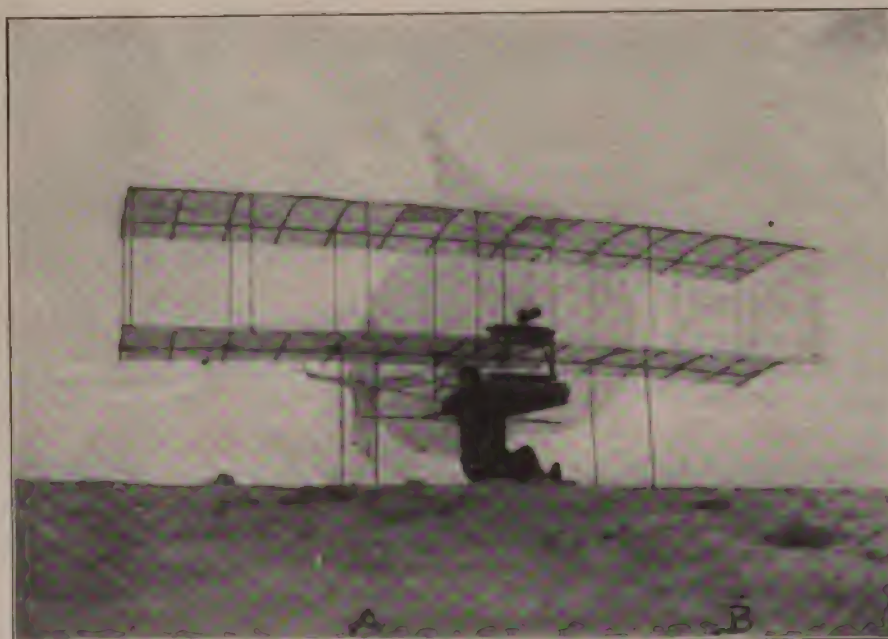
The professor's trip in air is thus described:

"In a few minutes everything was in readiness for a flight. The big door of the pavilion was raised and the machine, separated from the tail, was carried to the outside at the south end of the building. Here it was coupled to a brass tube from the air compressor and inside a gasoline engine was started, and the required pressure obtained in the charging tank. The tube was then uncoupled and the machine, with tail re-attached, was moved out into the open stretch, where it faced a twenty-five mile wind.

"The propellers were now turning at a furious rate by force of the wind. Mr. Herring crawled underneath the apparatus and raised it so easily that it seemed to possess no weight at all. A few forward steps were made, the motors shrieked and the machine leaped forward, an instant later sailing in free air, with the skids nearly a yard above the sand and the operator's legs drawn up in a bunch near the tank.

"It was really flying—already the machine had covered a distance of fifty or sixty feet when the speed perceptibly slackened and a little farther on the apparatus came gently to rest on the sand. The distance covered was afterward measured at seventy-three feet and the time of flight was estimated by Mr. Herring at eight to ten seconds. He explained, however, that though this represents a speed of only five or six miles an hour over ground, the real speed of the machine was more nearly thirty miles an hour, as it was advancing against a twenty-five mile wind."

Mr. Herring expresses himself as well pleased with the results so far obtained and expects to continue experiments with a machine capable of much longer flight next season.



A. M. HERRING'S COMPRESSED AIR FLYING MACHINE.

First motor machine to successfully carry an operator in free flight.

He feels that this experiment leaves little question of the possibility of building a machine which will fly and carry its operator. He considers it unlikely, however, that flying machines will ever carry freight or more than one or two persons at a time.

"Though my struggles with the problem have been long in the time consumed, much of them can be told in a few words," said Mr. Herring. "I had always felt that the problem held no difficulty which engineering skill could not meet, when I began work on it.

"In 1890, at a time when my means warranted, I began building steam models and experimenting in earnest to overcome difficulties, at first not even suspected, but which proved more and more formidable as time went on. The work was expensive and became so absorbing as to cause neglect of other interests. This necessitated abandonment, for a time. Later, my interest in the subject led me to take service with other experimenters, whose ideas differed radically from my own. I cast about in many directions for aid to continue my own experiments and met, as is usual in such cases, many disappointments. One newspaper even had my plans investigated by an expert, who reported them feasible, but nothing was done."

The construction of the present machine and the furthering of these experiments, which may have brought the world within sight of a practical solution of a 2,000-year-old problem, Mr. Herring modestly says, are more largely due to M. C. Arnot, of Elmira, N. Y., than to himself.

The gasoline engine, with 3 x 3 inch stroke, has an automatic timing lead to the igniter, and can be speeded up to 2,200 revolutions a minute.

As shown in the illustration the machine is just in the act of landing. The propellers are going at full speed and are almost invisible. On the ground can be seen just above A and B, the two waves or furrows of sand being spread by the advancing skids.

Professor Herring is now building a steam motor, which he hopes will be capable of longer flight. One of these motors has just been tested. It has a two-inch bore, a three-inch stroke, works with any pressure up to 250 pounds to the square inch and can be run at 2,500 revolutions a minute. At 200 pounds boiler pressure and 1,200 revolutions it gives over five and a half horse-power. It is fitted with ball bearings and ball bearing eccentric, and is made throughout of tool steel, for the most part tempered and ground to a fit. The entire weight of the motor is 2.73 pounds.

BICYCLE MOTORS.

Our old subscribers will remember the bicycle motor, which Professor Herring built several years ago, and which was shown and described in connection with his former flying machine. He is now getting some motor bicycles ready for the market. He hopes to have them out by June 20. The motors will be of the Otto type, variable speed, all working parts, including the two speed mechanism or change gears, being ball bearing and enclosed in oil-tight cases. The gearing of the motor is novel in that there are no cog wheels, and through friction any pull up to thirty-two pounds can be obtained at the rim of the wheel, which ought to enable a rider to climb a ten per cent. grade on a poor road.

The motor fits on the crank hanger of the bicycle.

The inventor hopes to sell the complete outfit at \$250. His present address is St. Joseph, Mich.

The General Carriage Co.

A sensation was caused in New York motor vehicle circles last week, when the facts regarding the General Carriage Co., the New Jersey corporation with \$20,000,000 capital noted in our last issue. The most interesting feature of this new competitor for business in New York State is not its large capitalization, which may be increased at the pleasure of the directors, but the broad charter or franchise it holds from the State of New York, by which it is empowered to construct and operate carriages and other vehicles drawn by horses or propelled by mechanical means on all streets of all cities of the first class in the State. A general freight business may also be done if desired. In fact the franchise practically gives the new company a monopoly of the public vehicle business in New York State.

The chief incorporators are Henry B. Livingston, of the New York banking house of Lee, Livingston & Co.; Reginald W. Rives, Edward A. Brennan, J. Frederick Kernochan and Thomas St. John Gaffney, but the real power behind the throne is said to be Richard Croker and his associates in the New York Autotruck Co., whose compressed-air system the new company has secured the right to use.

According to its charter the company may establish a "time service" and a "distance service," and subdivide the latter into a "mileage" and a "circuit" service. It is allowed to charge not more than seventy-five cents an hour for the time service, and not more than twenty-five cents a mile for the distance service for each person. And it may define the limits and boundaries of its circuits, making such regulations as to operation and fare as it may desire.

It is said the company will introduce stages running cross-town in New York in competition with the surface railroads, and that in the shopping districts three cent fares will prevail.

As to the franchise of the Fifth avenue stage line, in regard to the disposition of which many conflicting rumors have been current of late, it is now authoritatively announced that it has been purchased by the Electric Vehicle interests, but inasmuch as the charter of the General Carriage Co. gives them the right to operate their vehicles in Fifth avenue as well as elsewhere, the value of the Fifth avenue franchise is rather problematical.

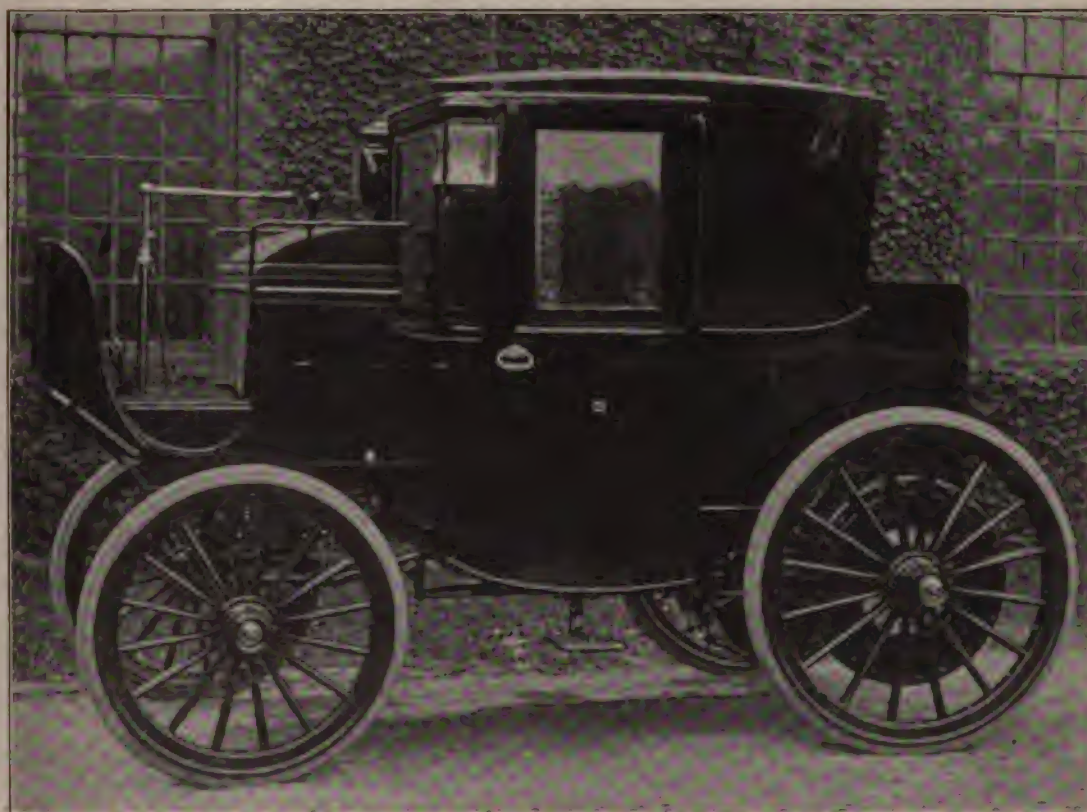
The Krieger system of electrical vehicles has been bought up, as has already been announced in our columns, and plans are being laid for the manufacture of large numbers of these cabs, to be put in service in the metropolis as soon as practicable. Gasoline systems are also being investigated by the General Carriage Co., which from all appearances is preparing for a determined onslaught upon the fortress of the Electric Vehicle Co.'s boasted monopoly.

The stock of the General Carriage Co. is all pooled until January 1, 1900, which allows ample time for these two great corporations to become better acquainted with each other, and take the measure of each other's power. Whether the result will be competition or an amicable understanding or absorption of the new rival by the Electric Vehicle Co. and the New York Electric Vehicle & Transportation Co. time will tell.

The Lander Transportation Co., Lander, Mont., are planning to introduce motor omnibuses to carry passengers from Casper to Walton, Lander, Thermopolis, Meeteetse, and the Yellowstone Park.



ELECTRIC RUNABOUT. COLUMBIA AUTOMOBILE CO., HARTFORD, CONN.



ELECTRIC BROUGHAM. COLUMBIA AUTOMOBILE CO., HARTFORD, CONN.



ELECTRIC VICTORIA. COLUMBIA AUTOMOBILE CO., HARTFORD, CONN.

The New York Electrical Exhibition.

LATEST COLUMBIA ELECTRIC VEHICLES.

The most recent types of electric vehicles built by the Columbia Automobile Co., illustrated herewith, comprise two pleasure vehicles of the lighter class, a brougham and an emergency wagon of the type used by electric railway companies in the large cities.

Fig. 1 shows a lady's small Victoria, the body suspended through fore and aft elliptical springs at the rear, and a transverse spring and spring irons at the front, upon a running frame of steel tubing. This carriage is driven through a tubular rear axle, split at the balance gear, but reinforced by a rod passing through its entire length, giving it stiffness, yet permitting the balancing of the two sides of the driving axle when necessary.

The balance gear and motor pinion are enclosed in the aluminum casing, permitting of running them in oil. The motor, hung between the rear axle and a cross tube, is built for twenty amperes and seventy-five volts, at which load it yields eighty per cent. efficiency. Its weight is 140 pounds. The total weight of the vehicle is 1,430 pounds; of the batteries 690 pounds. The usual electrical equipment is supplied, the forty-four cells of batteries being grouped in four boxes and giving, through alterations in the grouping, speeds of 15, 7.5 and 3.8 miles per hour. Three inch pneumatic tires on twenty-eight inch wheels are employed.

Fig. 2 shows a runabout phaeton for two passengers, the electrical and mechanical equipment of which resembles the Victoria very closely.

A brougham built for private use is illustrated by Fig. 3. The small details of this vehicle have been carried out with

all the completeness and elegance possible. The body is given an easy riding motion upon half platform springs at the rear, and a compound Brewster spring at the front. No reach is employed. The batteries are placed, two boxes under the driver's seat and two boxes at the rear. The interior is luxuriously upholstered in satin, broadcloth and leather, and contains such conveniences as an electric reading lamp, hand mirror, pockets and shelves for parcels, and a small clock set in the upholstery. An electric signal, operated by a push button within, affords communication with the driver at any time. A forty ampere motor is used on the vehicle, capable of giving eighty-three per cent. efficiency at normal load, and seventy-eight per cent. efficiency at 150 overload. It is spring suspended, and drives through the balance gear and a single reduction. The wheels are of wood and the tires solid. The batteries weigh 1,375 pounds, the carriage complete 4,100 pounds. The maximum speed is eleven miles an hour, and under good conditions of road twenty-five miles on a single charge can be expected.

A good illustration of one of the many useful and fit applications of the electric vehicle is shown in Fig. 4, the emergency wagon. This is equipped with all the appliances and tools carried on wagons of this type—fire extinguishers, extension ladder, stretcher, lanterns, and a complete kit of linemen's tools and apparatus.

It is built to carry a crew of four or five men at a speed of ten miles an hour for eighteen miles, this distance being much in excess of the requirements in this class of work. The batteries, weighing 1,400 pounds, are carried beneath the main body, and are removable at the side. The total weight is 4,500 pounds. Wooden wheels, forty-two inches in diameter at the rear and thirty-six inches in the front, with solid tires, are used.



COLUMBIA ELECTRIC EMERGENCY WAGON.

The vehicles of the Woods Motor Vehicle Co., Chicago, Ill., arrived the latter part of the week, and were installed in the space behind that of the Columbia Automobile Co. They are five in number—a Victoria hansom cab, a runabout buggy, a trap, a stanhope and a brake. These vehicles will be illustrated and described in the forthcoming issue.

The Riker Co. have introduced this week a theatre "bus and a ponderous truck, which they employ to carry their vehicles to the shipping points.

Electric Vehicle Messenger Service.

It is stated that the Electric Vehicle Co., of New York, intends to invade the messenger service field. That is, their motormen will give receipts for letters and parcels and deliver them at regular rates for distance. The calling of a cab and giving the driver a shilling to deliver a note or a package has long been an English fashion, but it has never obtained to any extent in this country.

But now the Electric Vehicle Co. intends to make the carrying of messages and parcels a feature of their service. No direct solicitation will be made, as it is a mooted question whether the present articles of incorporation cover it. But it will be understood around hotels, theatres and other cab stands that the cabbies will deliver letters and parcels at regular rates for distance.

Damage Suit in Philadelphia.

The first suit in the Philadelphia courts to recover damages for injury alleged to have been due to the use of motor vehicles in the streets, was commenced by George W. Burke on May 11, against the Pennsylvania Electric Motor Co.

Mr. Burke testifies that on April 17, his horse and wagon was being driven through the street when a motor vehicle, coming in the opposite direction, was operated in such a careless manner that the horse became frightened and ran away, wrecking the wagon and harness. Mr. Burke asks for \$1,000 to compensate him for the destruction of the wagon and harness, and the injury to the horse.

From the Consul General at Paris.

John K. Gowdy, United States Consul General at Paris, writes to the State Department as follows of motor vehicles in the French Capital:

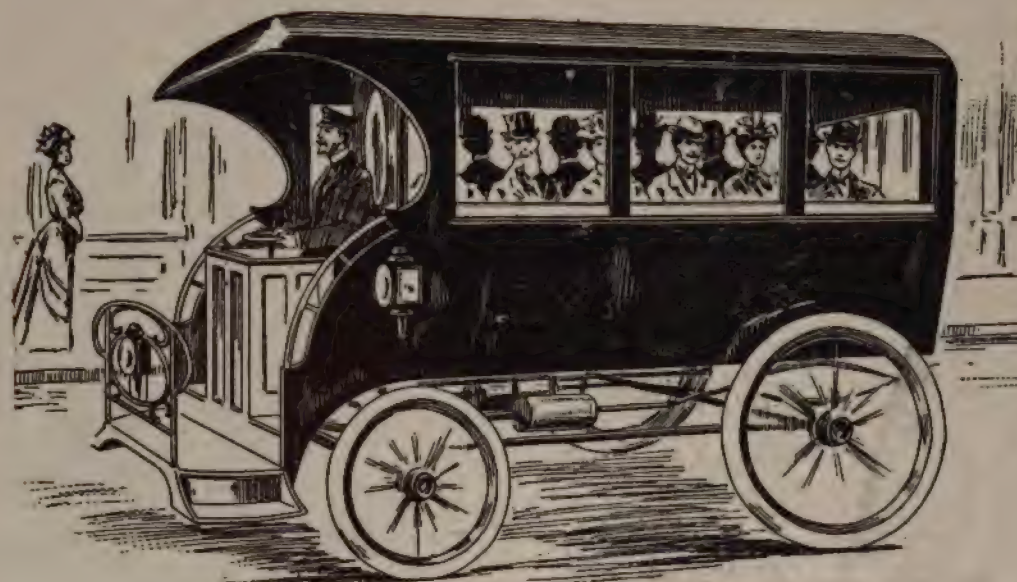
"On Easter Sunday, April 2, 1899, the first installment of automobile cabs was placed at the disposal of the Parisian public. As soon as they issued from the depot at Auber-villiers they were eagerly sought after, and gave most satisfactory results. The number of these vehicles is daily being increased, and the Compagnie Générale des Voitures expects, after a month's trial, to be in a position to judge of the convenience or drawbacks of the present type of cabs. Impressions of the woodcuts of the two types at present in use I inclose herewith. These vehicles are provided with accumulators, enabling them to travel from sixty to eighty kilometers (thirty-seven to forty-nine miles) without recharging the batteries.

"The tariff varies according to the number of persons. For one or two passengers, the ordinary cab fare is applied, viz.: 1.50 or 2 francs (28.9 or 38.6 cents) per hour; for three persons, 2 francs the journey, and four persons 2.50 francs (48.2 cents). Between 12:30 and 6 A. M. the rate is 2.25 or 2.50 francs (43.4 or 48.2 cents) the journey; and 2.50 to 2.75 francs (48.2 to 52.5 cents) per hour, according to the number of passengers. Fares beyond the fortifications will be 25 centimes (4.82 cents) above the existing rate for ordinary cabs.

"The eventual adoption of automobiles for general use in Paris, as well as throughout France, seems to be a foregone conclusion; but there is no doubt that the tremendous speed at which private individuals with their motor tricycles and other experimental automobiles dash about the streets has had a tendency to discourage the adoption of automobiles by those who would otherwise make purchases. By daily observation in Paris, it is easy to see that improvements are constantly being made in doing away with the objectionable odors, excessive vibration and noise.

"The action of the Compagnie Générale des Voitures in establishing the speed of its automobiles in the city at about eight kilometers (five miles) an hour, will diminish, if not avoid, the crushing of pedestrians and serious accidents. The element of fear being eliminated, the introduction of reliable, and not too complicated, mechanism will certainly produce a new era in locomotion throughout France.

"I may state that an important and appreciative merit in the new automobile cabs is the brake placed in the interior of the vehicle, by which the passenger can not only check the speed, but bring the conveyance to a standstill independently of the conductor. In order to have the trial complete and obtain the consensus of public opinion, registers are placed at each cabstand for such observations as individuals may see fit to make. It is the intention of the company to daily increase the supply of vehicles, as may be justified by the demands of the public."



STEAM 'BUS OF NATIONAL TRANSPORTATION CO.

Steam 'Buses in Boston Suburbs.

Motor vehicle promoters have been stirring lately in Boston and vicinity. Close upon the report of the plans of the great electric cab company that is going to fill the streets of the New England metropolis with the same kind of vehicles that are now in use in New York comes the news of another company which is about to supply the needs of Boston's suburbs, not by the use of electric power, however, but by the use of steam. This new organization is the National Transportation Co., incorporated under New Jersey laws, with a capital of \$50,000, and having offices in the Exchange Building, 53 State street. The officers are Artemas B. Upham, president; John L. Behneke, treasurer; J. Fred Beatey, manager, and Joseph W. Ferguson, engineer.

Franchises have been secured in Winthrop, Milton and other towns near Boston. The company now has under construction thirty-two 'buses with a seating capacity of from twenty-one to forty persons, six of which are to be running in the town of Winthrop by June 17, six more to be added soon after. Other routes where street railways are not wanted have also been secured by the company.

The body of one of these 'buses, as shown by the plan, will be about eighteen feet long and four feet five inches wide, with an ornamented seat for the motorman in front, and at the rear a vestibuled overhang of about two feet, with steps for entrance or egress at the sides. The material used will be thin steel, except for a small amount of wood paneling, while the body of the vehicle will be built entirely separate from the truck.

The engines are being constructed by a Dorchester firm. The boilers will be of the water tube variety.

The license granted by the town of Winthrop runs for a term of one year and stipulates that the fare shall not exceed five cents, school children being carried at half fare, and that the tires used shall be not less than two and a half inches wide.

LONDON NOTES.

LAWSON'S MOTOR BICYCLE.

Lawson's Motor Safety Co., Ltd., 40 Holborn Viaduct, London, E. C., is one of the latest results of Harry J. Lawson's efforts in connection with the motor industry. This company has been formed to exploit Mr. Lawson's new design of motor bicycle, of which as adopted to a lady's machine I send you an illustration herewith. It will be seen that the whole arrangement is quite new. The motor, which works with gasoline, is of one and a quarter H.P.; it is connected to the rear portion of the frame on one side of the rear wheel. The motor shaft passes through the hub of the rear wheel and carries a small fly-wheel on the opposite side. Tube ignition is employed, oil for the lamp being supplied from a separate pressure tank. The reduction of the speed of the motor, as compared with that of the rear wheel, is effected by means of epicyclic gearing connected to the inside of the hub by a clutch. The long oval-shaped tank seen behind the saddle serves a variety of purposes. It comprises an oil storage tank, a carburetting chamber, a tank for lubricating oil and a pressure tank for the supply of oil to the burner. The brake is so arranged that when applied the supply of explosive mixture to the motor is automatically cut off. Provision is also made that by means of a small handle and clutch the motor can be instantly thrown out of gear, thus enabling the rider to coast down hill, or to pedal in the usual way, without having to work against the motor.

The Val de Travers Asphalt Co., Ltd., of Hamilton House, Bishopsgate street, London, E. C., are open to purchase one or more motor wagons to carry a load of three tons at a speed of about five miles an hour.

El Sindicato Fundador de la Industria de Automobiles en Espana has lately placed an order for a Columbia electric carriage. This will be the first electric vehicle in the Spanish capital. The syndicate has been formed to promote the horse-

less vehicle movement in Spain, the moving spirits being Senor Batele and Senor Juan Gomez Hemas.

It is reported that the municipal authorities of Coventry, the seat of the English bicycle industry, are considering the question of adopting steam motor dust carts in place of the horse vehicles at present in use. A similar course has just been decided on at Glasgow, the municipal authorities having accepted the offer of a local company to provide an electric dust cart for the sum of \$2,660. In the one or two districts that have already adopted motor dust carts the motive power is steam. The decision of the Glasgow authorities to adopt electricity has created some surprise and the experiment will be watched with interest.

Public motor vehicle services are steadily increasing in France. The latest is one between Montmedy and Stenay, a distance of about twelve miles. The vehicles have accommodation for thirty passengers and are De Dion steam omnibuses.

Following the example set by New York, London and Paris, it is now announced that a service of motor cabs is shortly to be started in Vienna, the local authorities having just given the necessary permit for fifty such vehicles to ply for hire.

La Société de Construction de Cycles et d'Automobiles (La Marque Georges Richard), of Autenil, near Paris, a concern which has hitherto only built petroleum motor vehicles, is reported to have a new electric carriage on the stocks.

Quite the latest application of motor vehicles is to be found near Manchester, where the trustees of the Duke of Bridgewater are using them for the distribution of milk in the districts named.

An excellent indication of the increasing popularity of automobilism in Europe is shown by the rapid way new motor car clubs are springing up in every district. This week has witnessed the formation of no less than four new clubs, two in France and two in Germany. The first is at Calais, where the Automobile Club Calaisien has just been started under the presidency of M. G. Cordier. A similar club has just been founded at Lyons and between thirty and forty members enrolled. At Aix la Chapelle a club has been formed to be known as the West German Automobile Club, while at Stuttgart a preliminary meeting has just been held relative to the founding of a motor car club to include the whole of the province of Wurtemberg. The West German Club has quickly got to work, for on Sunday, May 14, a race between Aix la Chapelle and Coblenz, a distance of 144 kilometers, is to be run off, under its auspices.

For some time past the attention of the fire authorities in France has been centered on the application of motor vehicles to their special work. At the Paris motor vehicle show in June last year, Cambier & Co., of Lille, exhibited a motor fire engine, and now it is announced that the Paris fire brigade is having a special electric wagon built to carry the escape ladders and other tackle, in addition to fifteen firemen.

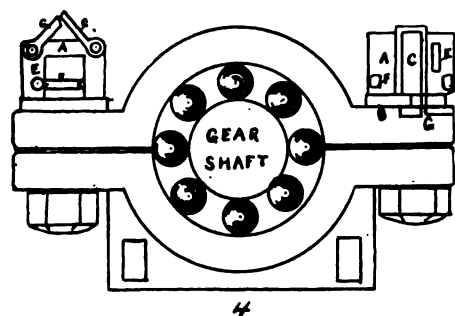
WANTED.

Special contributions to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

NOTES ON REPAIRS.

BEARINGS.

A point is to look out for hot boxes when overhauling a wheel. Every time a man can put his hand on the box or boxes, he should do so, even if he has the wheel only long enough to fill the tires. This habit should be acquired. Many a bearing has been prevented from giving out by doing this. Acquire the habit, and the care will not be irksome or fatiguing. The old style of bearing, in which the balls are con-



nected as shown at A, Fig. 4, often heats and wears both cones and balls, owing to the tendency of the balls running in grooves as a result of having but one point of contact, B, while the independent ball system gives points of contact from C to D, as shown in same figure; this permits the balls to have considerable roll from side to side and avoids grooving and consequently heating. Regardless of the style of bearing, however, it is a good plan to examine all bearings of wheels in process of being repaired.

LOCK NUTS.

The probable application of the gear and shaft system as a substitute for sprocket and chain will call for new types of journals and nut adjustments. In Fig. 4 a lock-nut arrangement which may prove serviceable. It consists of a round nut, B, provided with a collar, H, and a separate brass cup, A, inside of which is a coiled spring, one end, E, of which projects through the cap, as shown, while the other end is suitable for passing through a saw cut in the reduced end of the bolt inside, A. Part of the nut, B, which is reduced slightly in diameter, projects inside the cap, and has a groove all around it. Split pins, F, passed through holes in the cap, engage with this groove, thus fastening the nut and cap together, while allowing them to revolve independently of each other. The nuts can thus be screwed on or off the bolts as ordinary nuts. The cap is held so that the end of the spring inside the cap comes fair with the saw cut in the bolt, the hinged pawls, C C, being raised as shown in the left hand view, and the nut, B, screwed on. The cap, A, will not turn around, but will follow the nut along the bolt. After the nut is up, the cap is given a turn in the opposite direction to that in which the nut was screwed, thus putting the spring in tension. The pawls C C, are now dropped into the notches, G, in the collar of the nut, as shown, thus completing the operation.

The Cycles of Gas and Oil Engines.

By MR. JAMES D. ROOTS.

No. X.

The leading idea of the next column, Type 9, is that of a second or further expansion of the working charge after it leaves the working cylinder in another cylinder, and by means of a second piston or cylindrus, for further expansion may take place in the same cylinder on the other side of the same piston.

There are some patent specifications prior to the first one mentioned in the table, *q. v.*, apparently describing compound gas engines, viz.—Boulton, No. 766, of 1877; 2525, of 1878, and some others later, which appear to be constructed largely upon scientific principles known only to the inventor, and for that reason they were omitted. There is also a specification, Halliwell, 1450, of 1879, describing a non-compression engine, the charge of which is further expanded in another cylinder, but in the table, *q. v.*, only compression compound engines have been included, as the compound engine is essentially the engine of the future. There are also some, for an instance, Maynes, 1882, whose chief characteristic is continuous combustion, and these are therefore included in the next column, Type 10, Class 3. There is a patent of Mr. Dugald Clerk's, No. 4948, of 1882, which should probably have been included in the table, but the inventor clearly intended to work it with very little or no compression. There are numerous engines described in which two cylinders are used—the one or even both serving for pumping purposes to draw in the charge—the pistons in both of which cylinders receive the impulse of

the explosion simultaneously or nearly so. There are also two or three specifications in which it is the intent of the inventor to effect another working stroke by so cooling the working charge as to create a vacuum in a second cylinder. For obvious reasons these have not been included. Only those specifications are given in the table, the engines described in which are true compound engines. The definition of compound, as applied to internal combustion engines, has been taken to be, and this column only includes, those compression engines in which the charge is ignited, and after doing a working stroke therein, it or a portion of it, passes to another cylinder or cylindrus to expand and do a further working stroke.

In expanding to effect a second working stroke, the charge or a portion of it in which combustion is generally still going on, may pass to a second cylinder, to exert pressure upon a second piston, or it may pass to a second cylindrus, or expanding and contracting chamber, upon the other side of the same piston, in the cylinder in which the ignition took place.

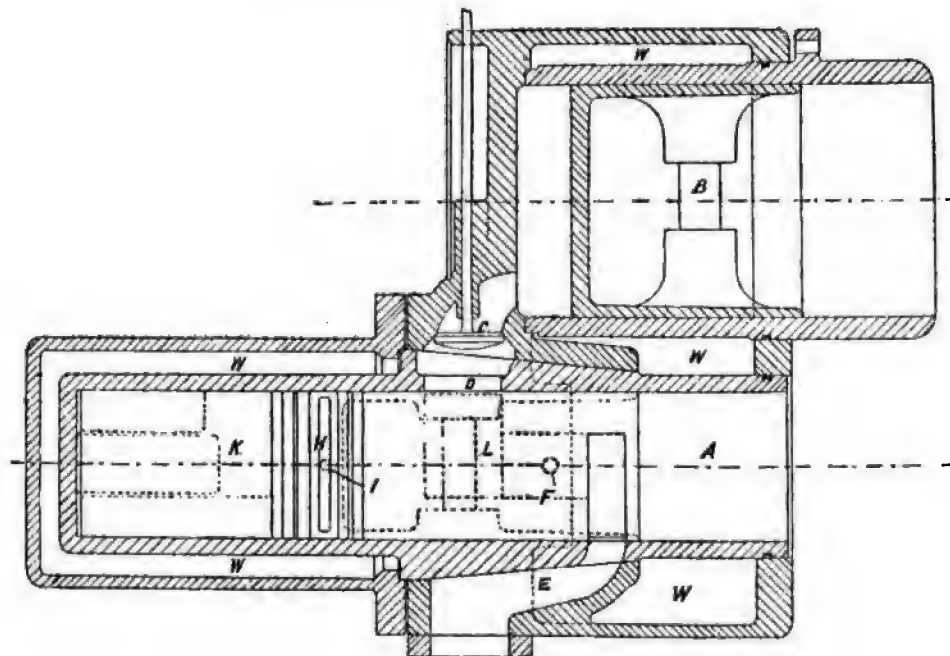
From the column Type 9, by a clerical error, the patent specification of Holt and Crossley, 1884, has been omitted. One of the engines described in this specification has been selected as the first representative of the compound engine, Class 2, Type 9, of the table.

Fig. 36A is a section through both cylinders of the first engine described in this patent.

The cylinder A is the high-pressure cylinder and B the low-pressure. The high-pressure crank is set from 70 degrees to 90 degrees in advance of the low pressure. C is a valve which closes communication between the two cylinders; the passage to the cylinder A is through a grid opening D. E is the exhaust port of the cylinder A. F indicates the

FIG. 36A

Holt and Crossley's Compound Engine.



Section through both cylinders of the first engine described in

Holt and Crossley's Specification of 1884.

position of the port for the admission of the gas and air. F should not really show in this sectional drawing, as it is on the top of the horizontal cylinder A. The high-pressure piston has a port H, which registers with the port F in the cylinder A. The projecting piece K, on the high pressure piston, is intended to prevent the passage of new charge through the exhaust port E.

The low-pressure piston B is at the beginning of its outstroke a little latter, the piston of A near its working stroke end uncovers the port D, and the valve C has been opened and is held open by a cam, the products in A pass through to B and exert pressure on the low-pressure piston. The high-pressure piston continues its outstroke and brings the port H in the piston opposite the port F, "and owing to the reduction of internal pressure caused by the continued movement of the piston of B a charge of gas and air is drawn" into the cylinder A. The piston of A on its return or instroke closes the ports F and D, and then compresses the charge and products remaining in A, and at highest compression the ignition port I in the piston registers with the port in the cylinder leading to the igniter, and the charge is ignited and the high-pressure piston does another working stroke. A port L communicates between the exhaust port E and the low-pressure cylinder to allow of the exhaust products being expelled on the instroke of the low-pressure piston. W is the water-jacket.

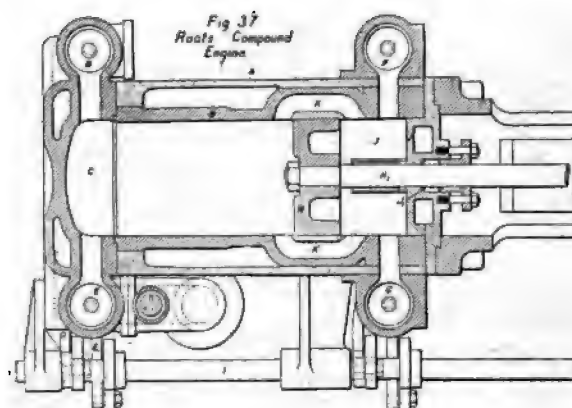
This engine was sufficiently ambitious, a great many things were attempted in its construction: (1) compounding; (2) the controlling the admission, ignition, and exhausting of the high-pressure piston, and the exhausting of the low-pressure piston by means of ports uncovered by the former, and the doing away with mechanism for valve opening other than that of the valve C; (3) the effecting the indrawing of the new charge without a pumping stroke. One of the chief objects of this construction was to do away with the slide, a source of great trouble at the time.

The almost obvious questions which arise are: What becomes of the benefit to be derived by compounding and the "propelling the piston of B" by the products, if the continued outstroke of B is to draw in the new charge? Would the new charge enter in sufficient quantity to fire while F registers with H? If it did enter in sufficient quantity, would it not flow out of the exhaust port in spite of the projection K on the piston? Or, on the other hand, would not the exhaust products be in excess of the new charge during compression?

The idea of compounding is familiar as applied to steam, but no attempt has yet been successful to overcome the difficulties to be encountered in making compound internal combustion engines. Nevertheless, it will be seen by reference to the column Type 9 of the table that the attempts to effect compounding are more numerous than one would expect. Only one engine having any similarity to a compound internal combustion engine, as far as I am aware, has been placed on the market. Speaking entirely from memory, this was, I believe, called the "Acme," produced by Messrs. Magee, of Glasgow, and was on view some years ago for a short time in a window in Broad street, city of London. I have not been able to obtain further particulars of this engine, but I think it was made in accordance with the patent specification 14,578, of 1886, which is not a true compound engine, and has not, therefore, been placed in the column Type 9. It is really of the de Rochas cycle, modified by the fact that the explosion pressure is exerted upon two pistons simultaneously—the crank pin of the one piston makes one revolution while

the crank pin of the other makes two. The second piston is merely a large piston valve so far as the de Rochas cycle is concerned.

To attempt compounding in internal combustion engines with two cylinders and pistons is, in my opinion, to court failure, except in very large engines. To convey the hot products of combustion from the hot cylinder to another and cooler one is necessarily to rapidly cool down the products and give to the walls of the second cylinder a large part of the heat which it is intended to use as power. A judicious heating of the second cylinder, or parts of it, by



an exhaust jacket might remove a part of the objection, but even then there are the increased friction, lubricating oil used, and first cost entailed in the use of the second piston and cylinder. A further difficulty that has to be encountered in internal combustion engines before compounding can be attained with advantage, is that of the cooling and expansion of the products by their rapid passage through a more or less contracted port to a cylinder having a lower pressure. I venture to think that the engine shown by Fig. 37—specification No. 17,308, of 1894—will overcome these difficulties. Fig. 37 shows a horizontal section through the cylinder of this engine. The de Rochas cycle operates with one variation at the back end of the cylinder, the same cycle, but without ignition, and therefore with only that amount of combustion arising from the flame which passes through the intermediate ports takes place in the front end of the cylinder on the other side of the piston.

In Fig. 37, A is the jacket cylinder, B the liner, C the cover, D the explosion and exhaust valve, E the admission valve for the mixture of the air and fuel, F the second expansion exhaust valve, G the admission valve for air to the second expansion end of the cylinder, D₁ the lever for opening the exhaust valve D, E₁ the lever for opening the admission valve E.

The two valves for admission and exhaust, F and G respectively, are opened in a like manner by levers and cams on the side shaft rotating at half the speed of the engine.

H is the piston, H₁ the piston-rod, I the rotating side shaft, J the second expansion cylinder end cover, J₁ the piston-rod stuffing-box; K K are the two ports by which the hot gases while still in a condition of combustion pass from the end C to the second expansion end J of the same cylinder.

The explosive charge is drawn through the admission valve E during the suction stroke, at the end of which, as the pressure on that side of the piston is as usual slightly below the atmospheric, a small quantity of the air and gases at atmospheric pressure on the other or second expansion side J,

which are then being exhausted, flow in through the ports K, the charge is compressed by the return of the piston H to a high compression, and is ignited at the dead point by a hot tube placed over the valve E, or other method, propelling the piston on its working stroke. Immediately the piston uncovers the ports K, near the end of the explosion working stroke the gases and flame pass through the ports K K into the cold air which has been compressed on the other side of the piston. Directly the piston covers the ports K K on the return or next instroke the exhaust valve D is opened, and the products are exhausted in the usual way. On the second expansion side J of the cylinder, the hot exhaust products and flame not only raise the temperature of the cold air, but also by increasing the total quantity of the gases increase the pressure on this side J. This pressure impels the piston on another working stroke, near the end of which the exhaust valve F is opened, and remains open in the usual way during the next exhausting stroke of the cylinder end J. During the next stroke air is drawn in through the valve G, which is compressed on the return stroke, and when the ports K K are uncovered the flame and products pass through, heating the air as before, and the double cycle continues. With the modifications described both sides of the piston carry out the operations of the de Rochas cycle, fuel being mixed with the air on the one side only, the combustion on this side serving to heat the charge of air on the other or compound side.

MINOR MENTION.

Samuel Insull has been chosen president of the Illinois Electric Vehicle & Transportation Co.

The Cincinnati Railroad Omnibus Co., Cincinnati, O., are investigating electric motor vehicles.

A. W. King, 71 W. Jackson street, Chicago, Ill., has applied for fourteen patents on a gasolene vehicle motor.

The Park Commission of Philadelphia has not yet decided whether motor vehicles will be admitted to the parks.

The Washington (D. C.) Automobile Co., has ordered a number of electric vehicles of the Columbia Automobile Co.

The Electric Vehicle Co., and the New York Electric Vehicle Transportation Co., have taken offices on the sixteenth floor at No. 100 Broadway.

John J. Mead, of Grand View, N. Y., is agitating for a line of electric stages to run from the Tappan Station of the West Shore Railroad and the Hook Mountain.

The Pittsburg Express Co., Pittsburg, Pa., has secured two electric parcel delivery wagons, which will be used to deliver parcels in the East End. It is reported that twenty of them will be needed.

The Board of Aldermen of Newton, Mass., where the well-known Stanley steam carriages are manufactured, are considering an ordinance limiting the speed of motor vehicles to ten miles an hour.

Albert T. Otto, president of the American Motor Co., sailed for Europe yesterday to be absent about a month. He will visit the leading centers of Germany, France, Belgium and England, in the interest of his company.

J. W. Fortune, representing the Canadian Motor Syndicate, Toronto, Canada, is in Detroit organizing a company to build a factory and put on the market the electric "motet," recently illustrated in our columns. It is said that a number of these vehicles will soon be for hire at the Detroit cab stands at \$1.00 an hour.

Plan of the Walshe Electric Carriage.

Mr. J. M. Walshe, of Syracuse, N. Y., whose plans for the manufacture of electric carriages at Cortland, N. Y., were mentioned in our last issue, writes that he has not yet applied for a patent on his battery, which, he says, weighs one-third less, has one-fifth more capacity, and will stand much harder usage than any other now on the market.

They will first manufacture a light runabout weighing about 450 lbs., selling at \$500, and running seventy-five or eighty miles on one charge. "It will be so arranged by a special system of charging that any person of ordinary common sense will be able to charge it from any place where there is an electric light or arc light."

The motor will be of the forging type, slotted armature and entirely enclosed, with back lash and compromise gear, to allow turning and backing up without overloading the motor.

COMMUNICATIONS.

A Good Suggestion.

CLEVELAND, O., May 11, 1899.

Editor HORSELESS AGE:

We understand that some of our competitors in your city have been industriously circulating a report that one of our carriages, owned by a gentleman in Brooklyn, had exploded and burned up his barn. We thought it strange that we never heard of the fire, and being in the city last week, we took the trouble to call on the gentleman, and we were informed that he was out riding in our carriage when the fire occurred in his barn, and that it caught from a coal stove which he keeps in the winter, and did but small damage. We would suggest that our worthy competitors go to work and get more carriages into the hands of the people, and in this way help the movement instead of talking about their neighbors. The field is ample.

Yours truly,
THE WINTON MOTOR CARRIAGE CO.,
Geo. H. Brown, Sec'y.

Believes in Licensing All Vehicles.

NEW YORK, May 8, 1899.

Editor HORSELESS AGE:

I greatly approve of licenses for all managers of quick-moving vehicles, and believe many accidents would be avoided by preventing boys from driving through the streets, and anyone from leaving animals unfastened, or unattended. I ride almost every clear morning; and for the past week have noticed that ninety per cent. of the animals left in the street are unfastened or unattended. Fifty per cent. of those driving have their lines so loose that they could not gain control of the animals to make a quick stop; but two of those about to turn, or stop, have given indication that I could see. Thirty per cent. of those riding bicycles have failed to turn to the right, or pass to the left. My brother-in-law, who has just returned from Europe, tells me that in many cities there, no one is allowed to ride in the streets without a license.

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MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

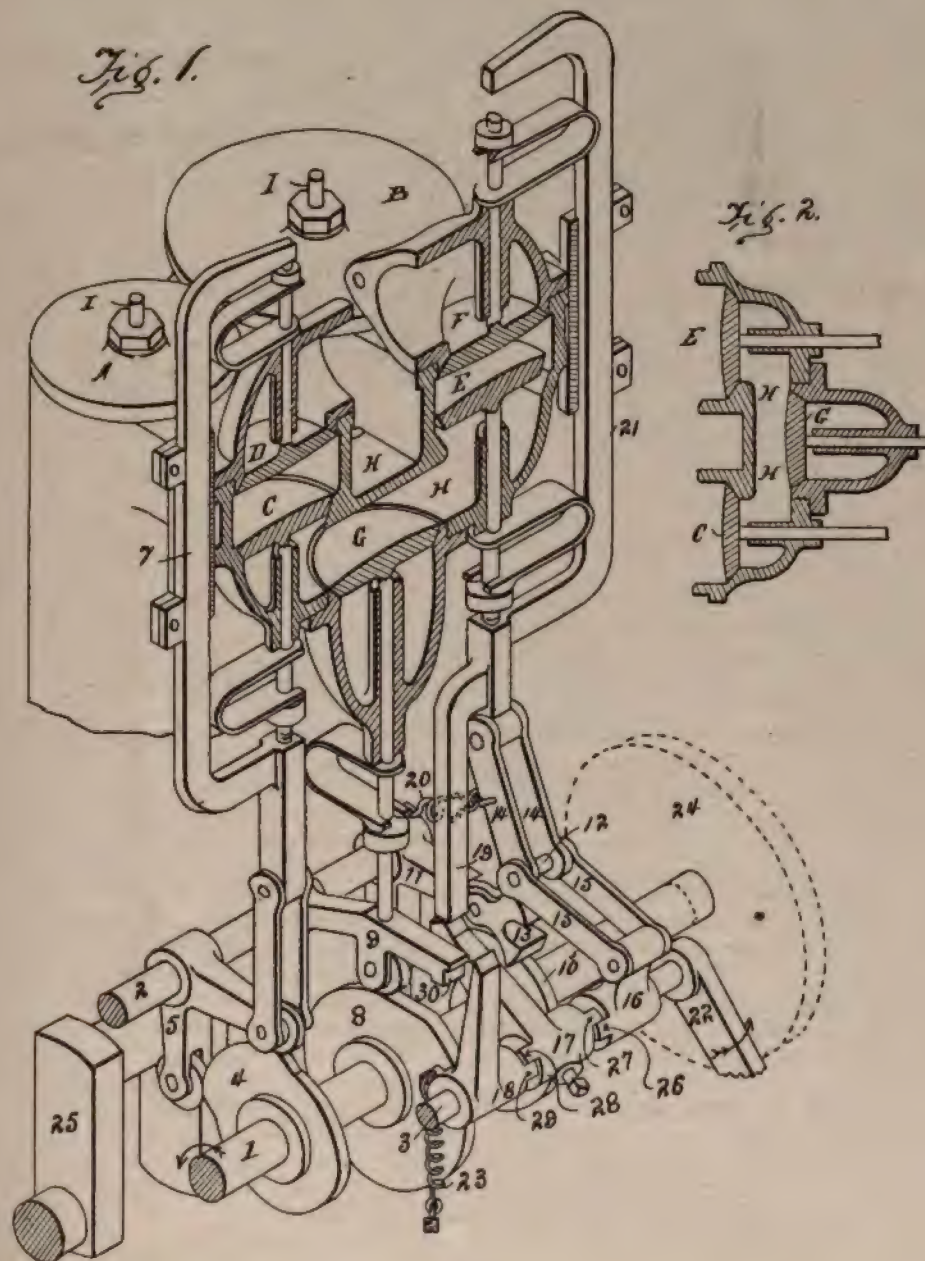
No. 624,649—Convertible Compound Explosive Engine—
Stephen Augustus Hasbrouck, New York, N. Y. Application
filed February 17, 1898.

The most important feature of this invention is the addition of an auxiliary valve operating in connection with the usual valves, and the mechanism for operating the valves. The invention also involves the addition of an igniter to the low-pressure cylinder.

Fig. 1 shows the valves and connecting-passage in section and the remainder of the mechanism, including the mechanism for operating the valves, in perspective. Fig. 2 shows simply a section of the valves and connecting-passage.

A and B are the cylinders, A being used as the high-pressure cylinder and B as the low-pressure cylinder when the engine is operated as a compound engine.

I I indicate the igniters for each cylinder. More than one high-pressure cylinder may be used in exactly the same manner, if desired.



D is the admission-valve, and C the exhaust valve, of the cylinder A. F is the admission-valve, and E the exhaust-valve, of the cylinder B. The admission-valves are each connected with the reservoir in which the gas or other medium is stored by a common supply-pipe, as usual. The exhaust-valves C and E open into and are connected by a passage H, containing an auxiliary valve G, opening on the outer air. The valves may be of any of the usual and approved forms. In the drawings they are supposed to be of the ordinary "pop" variety. The mechanism for their operation is illustrated in the drawings, Fig. 1, as follows:

The valves D and C are operated by a slide 7 which is attached by means of the links 6 6 to a bell-crank lever 5, which is journaled on a shaft 2. The valves F and E are operated by a similar slide 21, which is attached by the links 14 14 the pin 12, and the links 15 15 to a lever 16 on a shaft 3, turned by a crank 22. The slide 21 has an extension 19, which engages with another lever 17, fastened to the shaft 3. There is also another bell-crank lever 11 on shaft 2, having at the end of its upper arm a slot 13, adapted to engage with the pin 12.

The two bell-crank levers 5 and 11 and the lever 9 are actuated, respectively, by cams 4, 8, and 10 on a cam-shaft 1. The lever 17 is provided with a shoulder 27, which engages with the shoulder 26 of lever 16. Another shoulder 28 of lever 17 engages with the shoulder 29 of catch 18. 20 and 23 are springs operating as hereinafter set forth. When not actuated by the mechanism described, the valves are held in their seats by springs. The auxiliary valve G is operated by a lever 9, journaled on the shaft 2 and having a toe 30, adapted to engage with the catch 18, journaled on shaft 3. The cam-shaft 1 is actuated by the crank-shaft 25 by means of the usual gearing 24. The several shafts are set in the engine in the usual manner.

The method of operation of the mechanism is as follows, taking for the purposes of the description a gas engine of the usual type, with one high-pressure and one low-pressure cylinder. The drawings represent the machine in operation as a compound engine. The cam-shaft 1, actuated by the crank-shaft of the engine, which is started in the usual manner, revolves in the direction indicated by the arrow at one-half the speed of the crank-shaft, and the cam 4, engaging with the bell-crank lever 5, pulls down the slide 7 by means of the links 6 6, and thereby pushes down the stem of the admission-valve D, thus opening it and admitting the charge into the cylinder A. After the "toe" of the cam has passed the bell-crank lever 5 the slide 7 is brought back by the spring to its "neutral" position, thus closing the valve D. The same result may also be accomplished independently of the spring by using a cam provided with two toes of proper shape. The charge thus admitted is compressed and ignited in the usual manner and by its expansion furnishes the power-stroke of the high-pressure cylinder. At the end of the stroke the cam 4 pushes up the slide 7 by means of the bell-crank lever 5, and the links 6 6, thus opening the exhaust-valve C. The gas thus allowed to escape passes through the passage H and into the cylinder B through the valve E, held permanently open by the lever 17, supporting the extension 19 of the slide 21. The lever 17 is fastened by a set-screw or other convenient means on the shaft 3, which is operated by the crank 22 and locked in the desired position by a catch on the crank. The gas, being thus admitted to the cylinder B, expands further and produces the power-stroke of that cylinder, the igniter thereof not being used when the engine is working

compound. At the end of this stroke the cam 8 (also driven by the cam-shaft 1) lifts the lever 9, and thus pushes open the valve G, so that the charge is exhausted into a muffler or into the outer air. The valve G thus acts as the exhaust-valve for the cylinder B. While the engine is operated in this manner, the admission-valve F of cylinder B is held shut by its spring. The pin 12 is held out of engagement with the bell-crank lever 11 by the links 15 15 and the lever 16, which is locked in its required position by the shoulder 27 engaging with the shoulder 26. The catch 18 is held out of engagement with lever 9 by the shoulder 28 engaging with its shoulder 29.

When it is desired to change from a compound engine to a twin, this is done as follows: The operator unlocks the crank 22 and revolves it, as shown by the arrow. This lowers the lever 17 and allows the extension 19 and the slide 21 to descend and the valve E to be closed by its spring. At the same time the catch 18, being thus released, is lowered by the action of its spring 23 and comes into engagement with the toe 30 of lever 9 as such lever is lifted by the cam 8. The spring 23 holds the catch 18 in this position, and the lever 9, with which it is engaged, thus holds the valve G permanently open. Meanwhile the same revolution of the crank 22 releases the lever 16, and the spring 20 pulls the pin 12 into engagement with the slot 13 at the end of the upper arm of the bell-crank lever 11, where it is held in such engagement by said spring. The slide 21 is thus brought into connection by means of the links 14 14 with the bell-crank lever 11 and is actuated by the cam 10 in a manner similar to that described for the slide 7, bell-crank lever 5, and cam 4. (It is to be observed that when the engine is run as a "compound" the cam 10 simply rocks the bell-crank lever 11 without further transmitting its motion.) The crank 22 is then revolved still further to remove all danger of the shoulders 26 and 27 striking as the lever 16 oscillates. With the mechanism in the condition described each cylinder acts as a high-pressure cylinder and is operated in the same manner as that first described for the cylinder A, so that the engine becomes a twin high-pressure engine, and the auxiliary valve G being held permanently open the passage H becomes practically a part of the atmosphere. In this mode of operation the igniter for the low-pressure cylinder is used. To change back to a compound engine, the above operation is simply reversed and need not be described in detail. The crank 22 is revolved in the opposite direction, the shoulders 27 and 28 engage with the shoulders 26 and 29, respectively, the pin 12 is released from the slot 13, thus disconnecting the slide 21 from the bell-crank lever 11, the lever 17 comes in contact with the extension 19 and raises the slide 21, the catch 18 is disengaged from the lever 9 and the valve G thus released, and the engine thus returns to the condition first described.

No. 624,555—Explosive Engine—Hinsdale Smith, Springfield, Mass. Application filed October 4, 1897.

The piston-rod is formed in two sections B2, B3, the one telescoping the other and maintained normally in their most distended relations by the spring m.

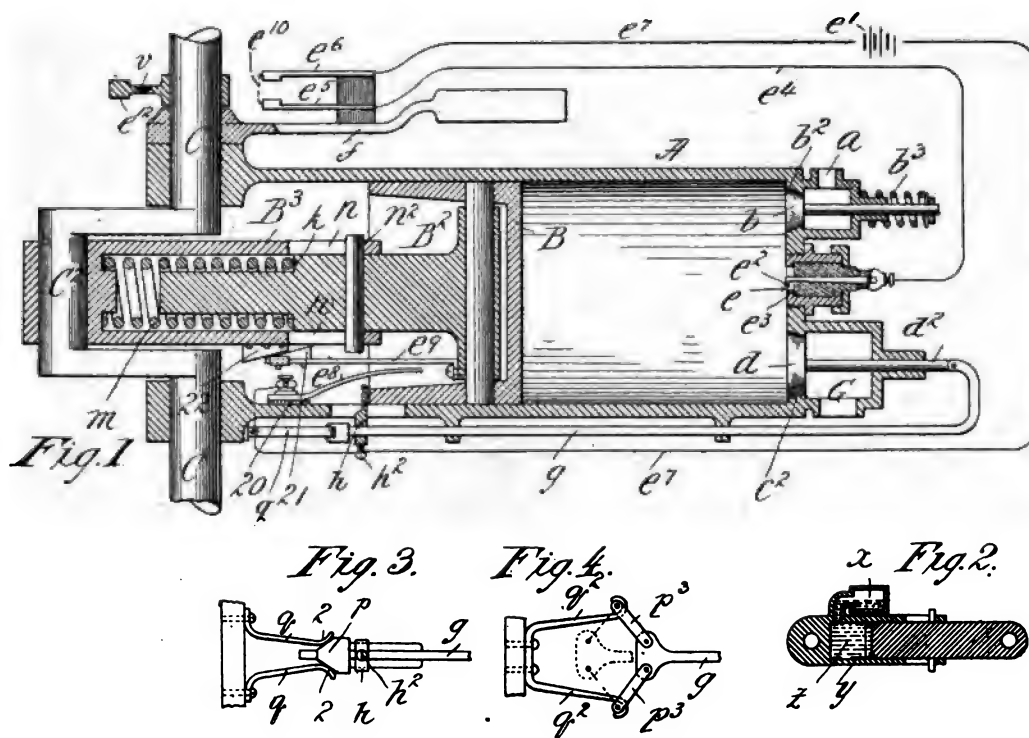
The piston-rod section B3, which is engaged with the crank or wrist pin C2, is tubular, while the piston-rod section B2 has a portion thereof fitting in the tubular section, its inner extremity being necked down, whereby the shoulder k is produced. The spring m is seated in the tubular piston-rod section and has its opposite end resting against the shoulder k. The said section B3 has the opposite slots n n, in which the extremities of the guiding-pin n2, which is passed

through a transverse opening therefor in the piston-rod section B2, have a sliding guiding fit.

There is an arm e12 affixed upon and radially extended from the crank-shaft, the outer end portion thereof being by the insulation v cut out from electrical connection with the crank-shaft, the extremity of this arm e12 having in its revolution a wiping contact on and disengagement from the paired adjacent contact pieces or fingers e5 e6. The said contact-fingers e5 e6 are mounted on a lever f, normally stationary, but adapted to have its position changed from a center of movement which is coincident with the axis of the crank-shaft.

Supported on and movable in unison with the piston or what is in substance the same, the piston-rod section B2, is the forwardly and longitudinally extending spring contact plate or finger e9, carrying at its end the incline 21, the piston of

B2 moving endwise relative to the piston-rod section B3 assures the action of the one incline 21 against the other 22 and offsetting of the extremity of spring-plate e9, so that the path of this extremity as it moves with the piston to the completion of said gas-compression action, just above referred to, is such that the said plates e8 e9 will contact at the proper time for the making of the spark, which is simultaneous with the instant that the arm e12 is in wiping contact on the terminals e5 e6. By slightly swinging the lever f upwardly or downwardly the contacting arm e12 will have its wiping action on the contacts e5 e6 correspondingly earlier or later in the revolution of said arm, and thus the instant of producing the spark may be determined to a nicety. It is also to be noted that the piston operates to open the exhaust-valve only at every other stroke—viz., the explosion-stroke—as the forward end of the piston does not reach the abutment h except



which is adjacent a second inclined block 22, mounted on the side of the piston-rod section B2.

The contact fingers or plates e8 e9 are arranged angular, the one relatively to the other.

By the provision of the normally open contact parts e8 and e9 notwithstanding the terminals e5 and e6 are joined at every rotation of the crank-shaft as the arm e12 comes around upon them there will not be a closing of the circuit, for the parts e8 and e9 are not joined at every forward stroke of the piston, but at or near the end of every second or compression stroke, for the reason that in its forward stroke next after the explosion or working stroke the piston is at its maximum distance from the crank, the spring being then uncompressed and the incline 21 of contact-plate e9 will merely pass the inclined contact e8 without touching it; but in its rearward gas-compressing movement the piston and piston-rod section

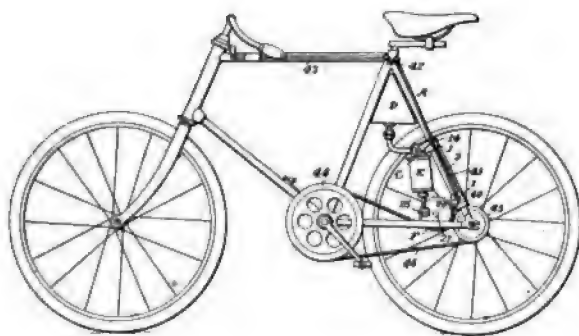
at the time it moves to its forward limit and when it is in its contracted relation to the crank under the pressure of the exploded gas.

No. 624,451—Pneumatic Brake and Motor for Vehicles—Franz Burger, Fort Wayne, Ind., assignor of three-fourths to Henry M. Williams, same place. Application filed January 6, 1898.

Fig. 1 is a side elevation of a bicycle with the mechanism embodying the invention applied thereto. Fig. 2 is a detail sectional view of the motor and connections. Fig. 3 is a similar view taken on a line at right angles to Fig. 2. Fig. 4 is a detail view of a portion of the motor and compression-cylinder and the distributing-valve, and Fig. 5 is a detail view of the driving and brake wheel and its clutch.

A designates the frame of a bicycle of ordinary construction, and B the combined brake, compression, and driving-

motor frame. This frame consists of two separated clamps 1, adapted to embrace a member of the frame A, the clamps being secured around the brace-rod 2 at one side of the machine. From each of these clamps extends a supporting-bracket 3, and in order to maintain them in proper relative position the clamps are connected by a bar 4, adapted to rest in contact with the brace-rod 2.



Supported to turn in separated ears 5 of the upper bracket 3 is a distributing-valve C, cylindrical in cross-section and provided with a main inlet-passage 7, from which two diverging branch inlet-passages 8 9 lead to its periphery, and with a main exhaust-passage 10, from which diverge two branch exhaust-passages 12 13, likewise leading to the periphery of the valve, one of the passages extending to a point on the periphery of the valve intermediate the branch inlet-passages 8 9. At one end the valve C is provided with an arm 14, and at its opposite end it is formed with a nipple 15, having a swivel connection at 16 with a supply-pipe 17, the passage of the nipple forming a continuation of the main inlet-passage 7 and coinciding with the passage of the supply-pipe. This supply-pipe extends to a compressed-air reservoir D, supported upon the frame A, and it is provided with a suitable cut-off valve 18 and with a by-pass 19, which communicates with the supply-pipe at points above and below the valve 18 and is provided with a check-valve 20.

Mounted to oscillate upon the distributing-valve C is a motor-cylinder E, provided at its upper end with an extension 21, provided with a transverse opening, into which is received to fit closely the distributing-valve C. At opposite sides the extension bears upon the inner faces of the ears 5, which prevent lateral movement of the cylinder relative to the valve. In the walls of the cylinder E are formed two passages 22 23, which lead, respectively, to the front and rear ends thereof and are adapted to register alternately with the branch inlet and exhaust passages of the distributing-valve as the cylinder oscillates.

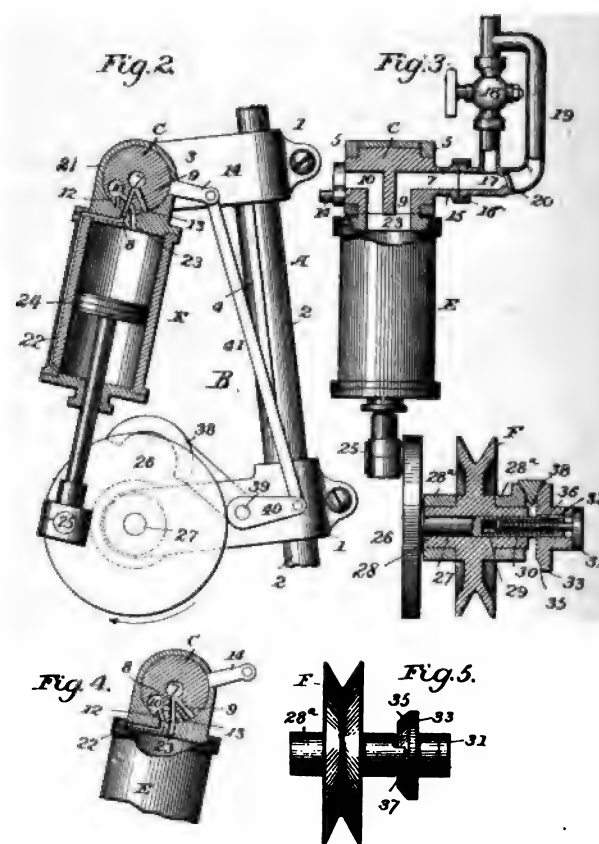
Within the cylinder E is a piston 24, the rod of which is connected at its lower end to a wrist-pin 25 upon a crank-disk 26. The shaft 27 of the disk 26 extends through the hub 28 of a brake or driving wheel F, mounted in bearings 28a of the lower bracket, and the shaft is adapted normally to rotate within the hub independently thereof. In its outer end the shaft 27 is provided with a circular chamber 29, into which extends and is adapted to move longitudinally a rod 30, provided at its outer end with a head 31. Mounted upon a projecting end of the shaft 27 and connected by means of a spline 32 to rotate therewith and to move longitudinally thereon is a clutch member 33, provided in its inner face with recesses 34 and with a beveled edge 35. The head 31 of the rod 30

bears against the outer end of the hub of the clutch member 33, and the rod is surrounded within the chamber 29 by a coil-spring 36, the normal tendency of which is to move the rod in the direction of the disk 26 and simultaneously carry the clutch member into contact with the end of the hub 28 of the driving-wheel F. The end of this hub is provided with two or more projections 37, which are adapted to enter the recesses 34 of the clutch member 33 when the hub and clutch are brought together, thereby effecting a connection between the shaft 27 and the driving-wheel F.

Any suitable means may be employed for effecting connection or disconnection between the clutch member 33 and the driving-wheel F.

The driving-wheel F is arranged intermediate the usual sprocket-wheels 44 45 of the bicycle, its lower edge extending below a straight line drawn from the upper edge of one of the wheels to that of the other, and the lower edge of the driving-wheel engages with the usual driving-belt or chain 46 of the bicycle, causing a bend in its upper limb intermediate the front and rear sprocket-wheels.

A belt is used to connect the wheels 44 45, the driving-wheel F being provided in its periphery with a wedge-shaped groove. A sprocket-wheel may be substituted for this wheel when the usual driving-chain is employed.



In operation, assuming the parts to be in the positions shown in Fig. 2, with the valve 18 open and the crank-disk 26 and driving-wheel F connected together, compressed air will flow from the reservoir D and enter the front end of the motor-cylinder E through the passages 7, 8, and 22, forcing the piston upward and rotating the crank-disk in the direction of the arrow, and by means of the engagement of the disk with the driving chain or belt 46 the bicycle will be propelled

forward. During the time the piston is moving upward the passages 13 and 23 have been brought to register with each other, and the air in the upper end of the cylinder escapes through the passages into the exhaust-passage 10 and out through the end of the distributing-valve. When the piston has reached the limit of its upstroke and starts upon its downstroke, the cylinder E is caused to turn upon the distributing-valve, thereby bringing the passages 7, 8, and 23 into communication, resulting in the introduction of compressed air into the upper end of the cylinder. This turning of the cylinder upon the distributing-valve also brings the passages 10, 12, and 22 to coincide, permitting the air in front of the piston to escape.

When traveling down grade, it is desired to reduce the speed of the wheel or when it is desired to replenish the reservoir with compressed air, the distributing-valve F is moved by the operator through the operating-rod 43 and the intermediate connections to the position shown in Fig. 4. The cut-off valve 18 is then closed, stopping the flow of compressed air to the cylinder. When the valve F is thus shifted, the passage 12 is brought to register with the passage 22 on the upstroke of the piston, causing air to be drawn into the forward end of the cylinder, and the passage 23 is brought into communication with the passages 7, 8, through which the air as it becomes compressed in the upper end of the cylinder escapes to the supply 17, forcing open the check-valve 20, and flows through the by-pass 19 to the reservoir. Upon the downstroke of the piston the cylinder E is moved to the left of the vertical, bringing the passage 22 into register with the passages 7, 8, and through these passages the air as it is compressed in the forward end of the cylinder is forced into the reservoir in the manner above stated. When the passages 7, 8, and 22 are thus brought to register, the passages 10, 13, and 23 coincide with each other, permitting air to be drawn into the upper end of the cylinder through the exhaust-port prior to the next up or compression stroke of the piston. When the motor is converted into an air-compressor, as above described, by reason of the resistance offered to the movement of the piston by the air as it is being compressed in the cylinder and the consequent retardation of the rotation of the driving-wheel, the wheel will act upon the driving chain or belt to decrease the rate of speed of the wheel. When it is desired to throw the motor wholly out of use, the valve-operating arm 14 is shifted through the rod 43 and the intermediate connections to throw the distributing-valve so far to the right that communication between the passages 8, 9, 12, and 13 and the passages 22 and 23 is prevented.

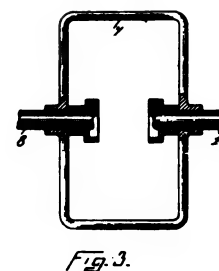
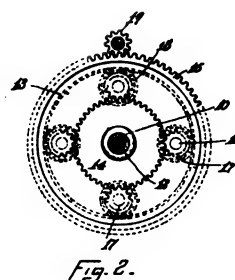
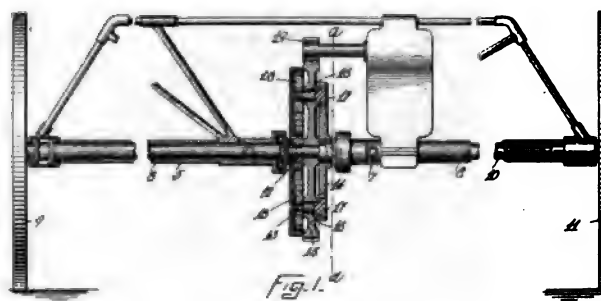
No. 624,519—Differential Gear—Charles H. Metz, Waltham, Mass. Application filed January 6, 1899.

Fig. 1 represents a vertical sectional view of the differential gear in connection with the driving mechanism of a motor vehicle. Fig. 2 represents a vertical sectional view of the differential gear, taken on the line a a, Fig. 1. Fig. 3 represents a plan view of the central portion of the shaft-frame.

In the drawings, 5 represents a tubular bearing of any well-known construction, and 6 is a similar bearing mounted in line with the bearing 5, but separated therefrom to admit the differential gear between them. In the present construction the inner ends of the bearings are connected by the frame 7. (Shown in plan view in Fig. 3.)

Journalled in the bearings 5 is the shaft 8, having any usual number of antifriction-bearings to co-operate with any such members as are carried by the bearing, and on the outer end

of the shaft is a wheel 9, representing the mechanism which is to be operated by this shaft. In the bearing 6 is journalled a similar shaft 10, having at its outer end the wheel 10, these shafts being held from longitudinal movement in their bearings partially by the antifriction-bearings and partially by the spreader 12, the reduced ends of which are rotatable in axially-disposed sockets formed in the inner ends of the shafts, so that the shafts may be independently rotatable.

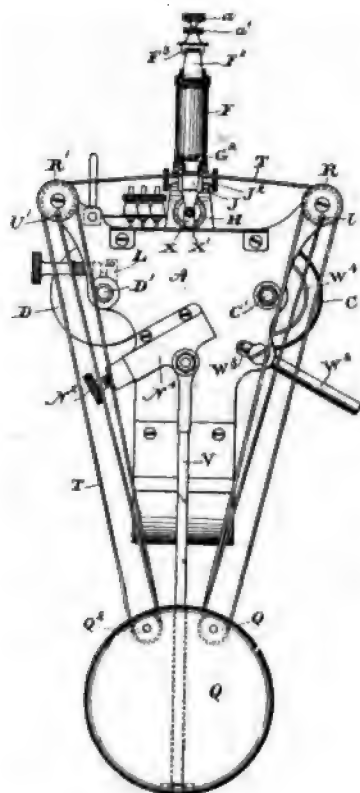


On the inner end of the shaft 5 is secured the internal gear 13, and on the inner end of the shaft 10 is secured the spur-gear 14, which is considerably smaller in diameter than is the internal gear. Between the ends of the shaft on the spreader 12 is journalled the disk 15, having a peripheral construction designed to be engaged by a portion of the driving mechanism. In the drawings this disk 15 is shown as having peripheral gear-teeth and is larger in diameter than the internal gear. In suitably-disposed bosses on this disk or gear 15 are formed bearings in which are journalled pinion-shafts 16, 16, having at one end pinions 17, 17, which mesh with the teeth of the gear 14, while to the other ends of these shafts 16 are secured the pinions 18, 18, larger in diameter than those marked 17, which mesh with the teeth of the internal gear 13.

When under normal conditions the disk or gear 15 is caused to rotate by the mechanism, as by the motor-gear 19, the pinions 17 and 18, with their shafts, form driving connections between the said gear 15 and the internal gear 13 and the spur gear 14, thus driving the shaft 8 and 10 and any mechanism with which the same are connected at a constant speed. If now either of these shafts be retarded, as by the cramping of one of the wheels shown in the drawings in turning a corner, the internal gear 13 or the spur-gear 14 is also retarded in its rotation, causing a proportionate acceleration of the rotative speed of the pinions and the gear 13 or 14, as the case may be.

No. 624,866—Grade Delineator—John Riddell, Schenectady, N. Y., assignor of one-fifth to Alexander F. MacDonald, same place. Application filed April 15, 1898.

Claim.—In a device for profiling a route traveled over,



adapted to be mounted on a vehicle and operated thereby. the combination of means for continuously moving the recording-surface as the vehicle progresses, a rotary marker, a support upon which the marker is free to rotate and also to move laterally, the arrangement being such that the marker may rotate without moving laterally or both motions may take place simultaneously, depending on the profile of the route traveled over, means for changing the position of the support as the profile of the route varies, whereby the marker is permitted to travel laterally along its support and across a recording-surface at an angle and indicate the profile of the route, and a flexible connector between said means and the support for preventing lost motion.

No. 624,827—Apparatus for Cooling Gas Engine Cylinders.—John W. Lambert, Anderson, Ind. Application filed October 16, 1897.

No. 624,678—Coupling Device for Vehicles—Joseph Planes, Neuilly, France. Application filed October 4, 1898.

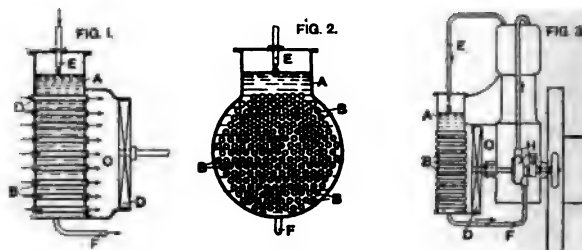
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FOREIGN PATENTS.

Water Cooling Apparatus for Explosion Motors.—G. Daimler, Cannstadt, Worttemberg.—Patent No. 10,257 of 1898. Published April 15, 1899.

This apparatus is mainly intended for motors employed on vehicles where only a small quantity of water can be carried. Figs. 1 and 2 show sectional views of the cooling apparatus, and Fig. 3 its application to a motor. It consists of a flat sided vessel, A, provided with a number of tubes, B. One end of these tubes opens into the atmosphere, and the other termi-



nates in a closed vessel, C, in which a fan, D, is arranged, driven from the motor shaft as shown in Fig. 3, and by the aid of which a strong current of air is drawn by suction through the tubes B. The water, after circulating around the cylinder, passes down the pipe E and enters the cooling vessel, from which it passes away through the pipe F, back again to the jacket of the cylinder sufficiently cooled for use again. For the purpose of maintaining a constant circulation in the cooling vessel, a small pump, H, is provided.

Volume I, No. 1.

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A new Winton motor carriage without a mar or scratch, every part in perfect order, been run 98 miles. Only reason for selling, owner has not time to use it. Numerous detail improvements have been added. Would not exchange it for one direct from the factory. Has extra tank for gasoline for long trips. Will sell at a bargain. H. N. GALE, Bristol, Conn.

VOLUME 4

MAY 24, 1899

NUMBER 8

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the
Motor Vehicle Industry.

ESTABLISHED 1895.

SUBSCRIPTION

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Single Copies, 10 Cents.

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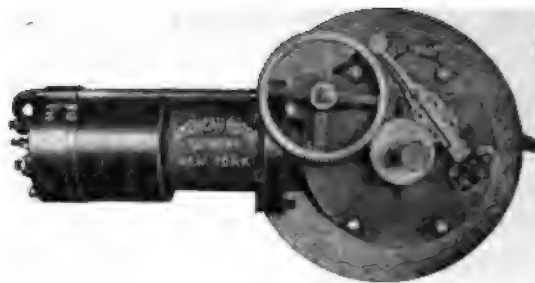
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EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. IV.

NEW YORK, MAY 24, 1899.

No. 8.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:

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by New York banks on small checks under their
new rule, subscribers are requested to remit by
Post Office or Express money order or N. Y. draft.

Seven Hundred Mile Run Against Time.

We have to chronicle in this issue the first public long-distance run of a motor vehicle against time in the United States. The distance of the run by road—from Cleveland, O., to New York city—is nearly 700 miles, which is amply sufficient to test the durability and sustained speed of a motor vehicle. While the run is against time the mad features of the road race are lacking. Rest, sleep and refreshment are not neglected, so that the journey may be compared with those which our grandfathers were accustomed to make in the days of the stage coach. Two hundred and eighteen miles in twelve hours over American roads is fast traveling. An average of eighteen miles an hour up hill and down dale, in rain and sunshine, is three times as swift as travel by horses, when fresh relays are taken every fifteen or twenty miles. Yet this same motor

carriage that made 218 miles in one day without delay or accident will make it, or more, the next day. As a road machine the horse is badly handicapped.

Light, but Not Too Light.

The progress that is being made abroad in the construction of light gasoline vehicles is exemplified in our London correspondence on another page. Carriages under 500 pounds in weight are now being put on the market both in Eng'land and Belgium at prices much lower than those charged for the heavier carriages of the early manufacturers. In making comparisons between American and foreign vehicles, however, our readers must always bear in mind the difference in roads. Rough roads require a heavier construction, and rough roads are the rule in the United States of America.

Electric Carriages for Ladies.

A new and decidedly appropriate development of the electric vehicle is seen in the runabouts and victorias intended for ladies' use, which are now on exhibition at the Madison Square Garden, New York. Electricity, in its cleanliness and ease of control, has undoubted advantages for ladies' use, particularly in cities, where the distances covered in a shopping tour or in a ride through the park or on the boulevard, are not great enough to tax the batteries, and the speeds allowable are well within the legal limit.

The manufacturers of this natty little class of equipage have made no mistake in introducing them to the public, and will surely find liberal patronage among our aristocratic ladies, who will soon be as enthusiastic over the motor carriage as the French *chauffeuses* are.

An interesting feature of a forthcoming issue will be an article on "The Evolution of the Motor Vehicle as Shown by Patents," by Leonard Huntress Dyer.

The New Stanley Model.

The new Stanley Model is nearly completed. Deliveries will be made in a week or ten days, and as the parts for 100 carriages are all completed it is confidently expected that four or five a day will be the average forthcoming in a short time. Few changes have been made in the new model. The body is longer, though the reach is one inch shorter. The engine has the link motion for reversing and cuts off at one-quarter stroke, thus economizing water.

Mr. Stanley states that he recently made a test to determine how far he could run without any fire under the boiler. He started with 150 lbs. pressure, extinguished the burners, rode a mile and a third and had sixty pounds pressure when he stopped, which he believes would have been sufficient to carry him half a mile further.

In regard to the liability of clogging and encrusting in small boilers such as he uses Mr. Stanley says that an ordinary stationary boiler running ten or fifteen hours a day will crust, if impure water is used and the boiler is not blown out frequently, but if a small boiler like his is always blown out after a run it will remain clean. In boilers of the Serpollet class the impurities in the water are much more liable to be precipitated because of the extreme heat of the tubes. Comparing his and the Serpollet boiler with respect to heating surface he said that the latter carried only three or four square feet to the horse power while his boiler, weighing but ninety pounds, had forty-four square feet. If fire is shut off the pressure in a Serpollet boiler goes down at once.

Large Factory at Detroit.

News comes of important developments at Detroit, Mich. The Olds motor carriage and the Olds stationary and marine gasoline engines are to be manufactured there on a very large scale. A plot of ground fronting 195 feet on Jefferson avenue and running back over 1,000 feet to the river has been purchased for the erection of works, which will comprise a machine shop, 300 feet long by 70 wide; a finishing department, 300 feet long by 52 feet wide, and a show room and office, 170 feet long by 50 feet wide. In addition there will be large buildings for the forging foundry and testing departments.

The officers of the new company are: S. L. Smith, president; Ransom E. Olds, vice-president and manager, and F. L. Smith, secretary and treasurer. It is said that by August 1st 150 hands will be employed.

The Olds works at Lansing, Mich., will continue in operation.

First Motor Emporium in Boston.

W. T. McCullough, proprietor of the Back Bay Cycle Co., has opened a branch store opposite, at 121 Massachusetts avenue, under the name of the Back Bay Cycle and Motor Co., where he is doing a general business in the sale, renting, storing and repair of motor vehicles. He has eight or ten De Dion tricycles and quadricycles which he rents at \$1 an hour and is making arrangements with parties who have ordered carriages to store and care for them as soon as they are delivered. This is the first store of the kind opened in Boston and, it is believed, in the United States.

The McCullough Motor Carriage.

W. T. McCullough, proprietor of the Back Bay Cycle Co., 122 Massachusetts avenue, Boston, and a practical mechanic of recognized ability, is the designer and builder of a gasoline carriage, herewith illustrated, which he is now subjecting to severe road tests with most satisfactory results.

The wheel base is fifty by fifty-four inches and the wheels are all thirty-two inches, with one-eighth-inch spokes; the frame is tubular, and the usual pivoted steering is employed, a self-locking device preventing the tiller from being knocked out of the hand by an obstacle and the vehicle suddenly deflected from its course.

A swivel joint in the front axle compensates for all inequalities of the road. All fittings of the frame are of cast steel, and the two and a half inch pneumatics are bolted on the rims. Twin motors, two and five-eighths by two and nine-sixteenths, upright and jacketless and each developing two and one-fourth horse power, are mounted on an independent frame. These motors, each weighing about fifty pounds, work independently, so that when only one is needed the other may be thrown out entirely. A crank is used to start the motor. The electric ignition is used, the jump spark being produced by a number of cells of dry battery.

The speed of the motor can be varied from 300 to 1,000 revolutions by the spark and the intake.

Transmission is by chains, one forward and two reverse, the intermediate speeds being obtained by changing the speed of the motor. A safety friction clutch operates the chains.

The control of the vehicle is easily accomplished, because all the valves are located on the steering apparatus.

An equalizing gear which distributes the strains of the road is a special feature, on which patents have been applied for.

The total weight of the carriage is about 520 lbs., and its maximum speed is twenty-five miles an hour.

FIRST AMERICAN PACING MACHINE.

Mr. McCullough also has the honor of having built the first pacing machine, all the parts of which are of American make. The machine is a tandem propelled by a two-horse power McCullough gasoline motor with radiating ribs and self-oiling crank case, set in the lower center of the frame and strongly braced.

The twenty-eight-inch wheels are fitted with two-inch pneumatics. The regular trussed frame is reinforced at the joints to allow for the extra strains, and the sprocket adjustment is from rear to front. The wheels are twenty-eight inches. The carbureter is a special feature. To secure absolute safety the gas is made in a separate compartment away from the gasoline. Transmission is by chain from a countershaft to the rear axle. The dry batteries furnishing the spark are carried in a case suspended from the top frame in front, while the gasoline tank and carbureter are placed behind the motor. The control of the machine is accomplished by means of two tiny levers just in front of the handle bar on the right hand side. One of these regulates the throttle valve and the other the carbureter. Power is transmitted by means of a pinion and gear at a reduction of ten to one.

An improvement over foreign machines of the same and similar class is found in the ignition plug, which is protected from injury by the radiating ribs of the motor and by the gasoline tank. In small gasoline motors of foreign manu-

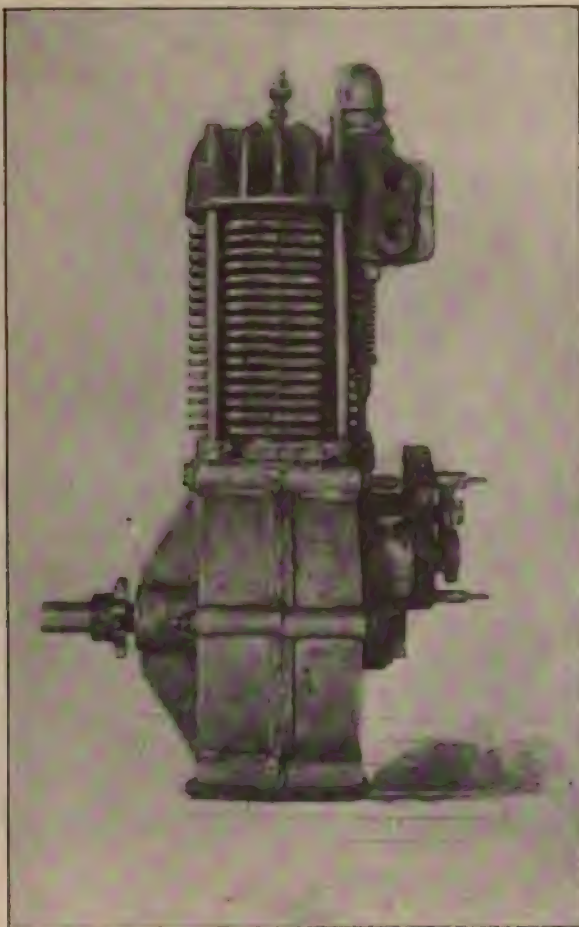


FRONT AND REAR VIEWS OF M'CULLOUGH MOTOR CARRIAGE.



THE M'CULLOUGH GASOLENE CARRIAGE.

fracture the porcelain plug is sometimes broken by a fall or from other accidental causes. The motor is capable of very high speed, even 2,200 revolutions a minute, so that it is nec-



THE M'CULLOUGH GASOLINE MOTOR.

essary to gear it down considerably to enable the rider to assist the motor without too rapid revolution of his feet. At the above number of revolutions it is estimated that the pacing machine will make forty miles an hour.

Stanley-Whitney Steam Carriages.

At the works of the Stanley Manufacturing Co., Lawrence, Mass., licensees under the Whitney patents, quite a number of carriages are nearly ready for assembling. Improvements in detail and finish have been made throughout the entire construction. Two frames are employed one for the motive power and the other for the running gear, leaving the body without rack or strain from the road.

The wheels are smaller than in the original Whitney carriages, being only 34 and 38 inches. The boiler is considerably heavier, weighing over 140 pounds instead of about 90, and being tested to a pressure of 1,500 pounds to the square inch. Great pains is shown in the construction of this important part of a steam vehicle. All the holes are drilled from template to assure perfect uniformity and interchangeability, and the joints are carefully "caulked" to prevent any possibility of leakage.

Hand forged parts are used instead of castings, and all gears are turned from solid blanks.

Any style of body may be employed, by means of the loosening of four bolts. The frames in the finished vehicles will be japanned.

The total weight of the carriage is between 800 and 900 pounds, and all parts are being built on the interchangeable plan, so that they may be readily replaced in case of wear or breakage and exact uniformity may be secured in the product.

Mr. Henry Promises Important Developments.

John C. Henry, the well-known electrical engineer of Denver, Col., is building an electric vehicle to exemplify some important improvements he is said to have made in regenerative controllers, by means of which a vehicle will be accelerated and controlled with one lever. The same handle that turns on or off the current operates the brakes. In short, the motor is converted into a dynamo, and when the current is shut off the momentum regenerates electricity, storing it in the battery, and checks the vehicle at the same time. In going down grade the power that would ordinarily be pressed against the mechanical brakes is shifted into the battery, so that it is replenished, and the vehicle is, at the same time held in check and runs with a regularity as on level ground.

The steering will also be electrical. In place of the present system the motors will be so arranged that by a simple turn, it is said, the machine can be steered around a corner, or zigzag with more accuracy and rapidity than mechanical steering would permit.

Mr. Henry is at work daily on arranging the parts and plans and promises additional novel features that he cannot now speak of because patents are pending.

Mr. Overman's Road Work.

The residents of Chicopee Falls, Mass. have become well accustomed to the sight of the Overman steam carriage which is now undergoing thorough road tests at the hands of Mr. Overman and the inventor J. O. Bullard, putting on the refinements as Mr. Overman calls it.

In reference to the regulation of the water supply Mr. Overman states that they guarantee to keep the water glass level within an inch but actually keep it within half an inch; and the fuel they guarantee to keep within two pounds, but actually keep it within one pound.

When asked whether he anticipated any trouble from his boiler clogging or encrusting, he replied that if a crust should form on the tubes owing to the use of lime water, rain water would immediately dissolve the crust, hence no serious difficulty need be experienced.

Mr. West Loses His Case.

J. B. West, Rochester, N. Y., who was sued for damages amounting to \$49, by a laundryman whose horse became frightened at a steam carriage Mr. West was running, lost his case, judgment to the amount of \$53.40 being awarded by the court. It is said that the case will not be appealed.

N. Y. Electrical Exhibition.

RIKER ELECTRIC BROUGHAM.

One of the most sumptuous electric vehicles ever constructed is the brougham exhibited by the Riker Electric Motor Co., Brooklyn, N. Y., intended for a London customer.

The vehicle has a wheel base eighty inches by fifty-nine inches; wheels thirty-six-inch front and forty-two-inch rear, with two-inch solid tires. Its carrying capacity is two persons besides the operator and attendant.

There are two motors of two K. W., each geared by a reduction to the rear axle. The controller gives three speeds forward and two to the rear, the maximum being ten miles an hour. The total mileage on each charge of battery is twenty-five on level macadam roads.

The rear wheels are the drivers and the front the steering wheels. A combination voltmeter and ammeter is attached to the dashboard and electric side lights are without, while within the richly upholstered interior are an electric reading light, a speaking tube, coach clock and a receiving rack.

The weight of this luxurious equipage is 4,000 pounds.

Another new Riker vehicle put on view since our last issue is a phaeton for Mr. Riker's private use, weighing only 1,890 pounds and having four speeds—six, twelve, twenty-four and thirty miles an hour—the very high speed being obtained through a novel winding of the armature.

On Wednesday, the 24th, all the vehicles on exhibition and fifty cabs of the Electric Vehicle Co. will participate in an excursion or run through the park and up to Grant's tomb

and back, taking as passengers the ladies of the visiting members of the National Electric Light Association, now in convention in New York City.

A demi coach and a theatre 'bus are also recent additions to the Riker exhibit.

From Cleveland to New York Against Time.

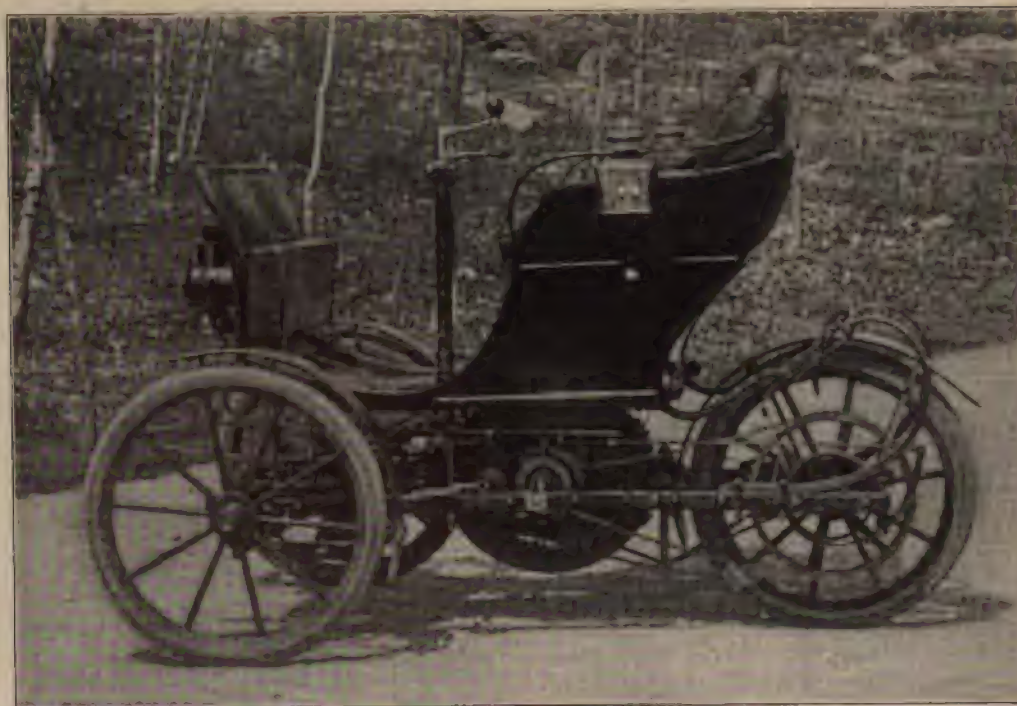
Alexander Winton, inventor of the Winton Motor Carriage, started from the city hall, Cleveland, O., at six o'clock on Monday morning, the 22d, in an attempt to establish the motor carriage record from Cleveland to New York.

Mr. Winton takes a message from Mayor Farley, of Cleveland, to Mayor Van Wyck, of New York. He was scheduled to make 100 miles a day, but exceeded this considerably. He is using his own private carriage which had traveled over 12,000 miles before he undertook this journey.

Erie, Pa., was reached at noon with a strong head wind blowing, and at 2 p. m. the machine left that place against the same disagreeable wind. At a quarter after eight in the evening Buffalo was reached, the cyclometer showing a run of 218 miles. Twelve miles beyond Erie a brewery wagon was overtaken. The driver was asleep and, his horses taking fright, he was thrown to the ground, but not seriously hurt. It rained hard on the forty-mile stretch between Silver Creek and Buffalo. The journey was resumed at 8 o'clock Tuesday morning via Rochester, Syracuse and Albany.



RIKER ELECTRIC BROUGHAM.



THE BRAMWELL-ROBINSON SOCIABLE.

The Bramwell-Robinson Sociable.

A very natty little three-wheeled carriage has been undergoing tests for some months past on the roads of Hyde Park, Mass., a few miles out of Boston. These tests have been very thorough and their result so satisfactory that the Bramwell-Robinson Co., designers and builders of the new carriage, are now putting the finishing touches on three of them and are making preparations to put through a lot of twenty-five at once.

The inventors are W. C. Bramwell, a well-known and successful inventor in other lines, and C. C. Bramwell, his son, who have formed an alliance with John T. Robinson & Co., manufacturers of paper box machinery, of Hyde Park, to engage extensively in the manufacture of this and other styles of motor vehicles under the name of the Bramwell-Robinson Co. The weight of this new variety of American motor carriage is 725 lbs. The tread of the wheels is fifty-four inches. The wheels are twenty-eight inches, the front or steering wheels being fitted with two-and-a-half inch pneumatics and the rear driving wheel with a three-inch pneumatic. These wheels are unlike any that have been used on motor vehicles up to the present time. They are all metal, but the spokes are of steel tubes instead of steel wire and cannot collapse or buckle, it is claimed, under any road strains. Their solidity may be judged from their weight, which is twenty-eight pounds each for the front and fifty pounds for the rear wheel and sprocket. The frame is a combination of wood and steel, giving great elasticity. There are no brazed joints. The front axle is of tool steel, the wheels running on common bearings. In the rear axle, however, large roller bearings are employed.

The motor is so hung that no part of it is connected to the frame, hence it is free from the strains of the framework and runs always true and in line.

The body, which is wide enough to seat two persons comfortably, is hung on C springs.

The three-horse power, jacketless motor has a four-inch bore, a six-inch stroke and weighs about 240 lbs. It has radiating ribs and on account of its exposed position all surplus heat is easily carried off. It is of the Otto cycle, making 200 to 1,020 revolutions a minute. A regular baffle plate carbureter is used, as also electric ignition by means of a wipe spark, a primary battery furnishing the current. The speed of the motor is regulated by the spark and the intake, as is now customary. To avoid binding of the journals the transmission is mounted with the motor. All the machinery is encased to protect it from dust and mud.

A chain from the motor shaft carries the power direct to the rear axle, two speeds being secured by means of a friction clutch. There is no reverse. With the motor running at a normal speed of 600 revolutions these speeds are three and ten miles an hour. The maximum speed is sixteen miles an hour.

All the controlling levers are conveniently arranged on a center-post. The handle at the top is for steering; the one which reaches toward the operator regulates the gear, while the long handle in front is connected with a band brake on the hub of the driving wheel. When the brake is removed the latter lever moved backward increases the speed of the motor, and if moved forward applies the brake. The gasoline tank and batteries are under the seat which, nevertheless, leaves room for bundles, too.

A point of advantage which the inventors wish to call particular attention to is the closeness of the steering pivot to the line or plane of the wheel, a construction which is not possible in the tangent wire wheel commonly used and which renders steering very easy. Another feature is the interchangeability of parts even to the inlet and exhaust valves and the sparking mechanism, duplicates of which are fur-

nished with each vehicle to be kept constantly on hand so that if a new part is required it can be put in place in two minutes. No packings are used in any part of the machine.

Owing to the correctness of the mixture and the fact that the cylinder oil is kept out of the combustion chamber no objectionable odor is thrown off by the exhaust.

Electric Vehicle Companies for Every State and Territory.

The plans of the electric vehicle syndicate are gradually unfolding. Last Friday an important step was taken in the organization of seventeen companies under New Jersey laws, sixteen of them with a capital of \$100,000 each, and one with a capital of \$6,000,000. The latter company is to operate in Washington, D. C., while the others are to be distributed in Tennessee, Georgia, Ohio, Kentucky, New Jersey, Louisiana, Delaware, California, Michigan, Minnesota, Iowa, Maryland, Wisconsin, Indiana, Missouri and Virginia. It is said that the capital stock of these sixteen companies will soon be greatly increased and that similar companies will be organized in every State and Territory of the Union.

HERE AND THERE.

E. Squier and A. J. Root, Virginia, Nev., are building a gasoline motor carriage.

The Consolidated Traction Co., of Pittsburg, Pa., has purchased a Columbia electric emergency wagon.

The H. B. Adams Co., manufacturers of bicycle and motor vehicle hubs under the Lake patents, have taken offices in the Witherspoon Building, Walnut and Juniper streets, Philadelphia, Pa. The capital of the company is \$500,000.

The Graef Motor Co., Brooklyn, N. Y., has filed articles of incorporation with the New York State authorities. The capital stock is \$250,000, and the directors are Ernest W. Graef, Edward L. Graef, H. A. Bubner, George Eckstein and James C. Church, of Brooklyn, N. Y.

W. R. Bullis, Chatham, N. Y., master mechanic of the Lebanon Springs Railroad, has fixed his gasoline motor, referred to some time since in our patent department, to a railroad velocipede with most satisfactory results. The motor weighs only twenty pounds, but develops unusual power. He contemplates manufacturing them for bicycles.

A recent New York State incorporation is that of the Standard Motor Manufacturing Co., of Glen Cove, L. I., capital, \$150,000, to manufacture gasoline motors, motor launches and motor vehicles of all kinds. The directors are Frederic C. Penfield, Carl C. Riotte, Augustus T. Gillender, Carlton R. Radcliffe and Edward Swan, of New York City. Mr. Riotte is the inventor of a gasoline motor.

WANTED.

Special contributions to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

LONDON NOTES.

LONDON, May 6, 1899.

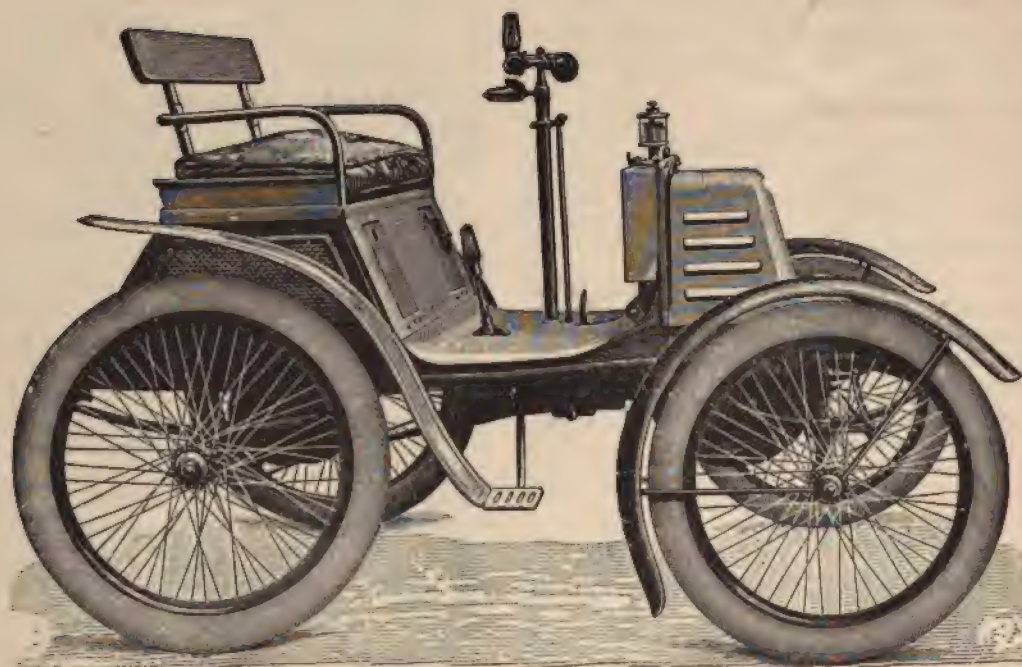
THE STAR MOTOR CARRIAGE.

Although several large English cycle-makers are reported to be building experimental horseless vehicles, the Star Co., of Wolverhampton, is the first English cycle company to start building motor-carriages on a commercial scale. It cannot be said that the "Star" vehicles show any great originality in design; they are to a large extent duplicates of the popular two and three seated carriages of Bentz & Co., of Mannheim, Germany. The motor, a gasoline one, of the horizontal type, is made in two sizes—two and nine-tenths horse power and three and a half horse power. The ignition is electric and the cylinder is provided with a water-jacket. Two mechanical speeds are provided, intermediary speeds being obtained by advancing or retarding the ignition. Transmission is effected through two belts working on fast and loose pulleys to a countershaft, and from the latter to the rear axle, through the usual sprockets and chains. Wire wheels and pneumatic tires are employed. Two brakes are used, while steering is effected by a bar connected with the front wheels. On a good road the carriage will, it is claimed, average sixteen miles an hour. A feature of the "Star" carriage is its relatively low cost, ranging from \$675 to \$750, according to the finish. The Star Motor Co. are also taking up the manufacture of motor tricycles of the De Dion type.

THE VIVINUS MOTOR CARRIAGE.

One of the latest firms to cater for the growing demand for a light motor carriage at a popular price is the Société des Ateliers Vivinus, of 244 Rue du Progrès, Brussels, Belgium, which has lately introduced the little two-seated carriage herewith illustrated. The motor employed is a vertical gasoline one, arranged in the front portion of the vehicle on the Panhard-Daimler system. It is stated to be capable of developing three and three-tenths horse power. The ignition is electric, while radial ribs are depended on for keeping the cylinder cool, no water-jacket being employed, the makers claiming that by placing the motor in the front portion of the carriage its use is avoided.

Two forward speeds are provided, the transmission from the motor shaft to the countershaft being by means of a single belt and two sets of pulleys. The belt normally runs loose and when "shipped" on to one or the other pair of the pulleys, is tightened and consequently made to grip, by means of a jockey pulley, controlled by a foot pedal within convenient reach of the driver's foot. No driving chains are employed, the transmission of power from the countershaft to the rear axle being by means of spur wheels, the one on the rear axle surrounding the differential gear. Although only two fixed speeds are provided any intermediate speed can be obtained by advancing or retarding the electric ignition. In consequence of the absence of water-circulation more space is available for the storage of gasoline, the storage tank having a capacity sufficient for a run of ninety miles. The wheels are of the cycle type, fitted with pneumatic tires. Steering is effected by means of the front wheel from the steering standard in the usual way. The carriage weighs only about 325 pounds and one of its features is its relatively low cost, \$600. Although this little carriage has only been

*The Star Motor Car*

THE VIVINUS GASOLENE MOTOR CARRIAGE.

on the market a few weeks, it has soon attained popularity for, up to the end of April, orders for no less than 130 had been taken.

CONTROL CONTESTS.

The "Control Contests," organized by the Motor Car Club, were held May 6th on the grounds of the Crystal Palace at Sydenham. The trials were not devoted to speed but to the question of control, and for this purpose a course of about two miles was marked out in the grounds of the Crystal Palace, this course comprising several steep ascents and declines, as also several sharp turns. Furthermore six points were fixed along the course at which the cars had to be brought to a standstill and started within thirty seconds of the signal being given. The interest shown in the contests is well indicated by the fact that no less than 153 motor carriages and cycles put in an appearance, the majority of these coming down from London in procession. The control contests were divided into five classes: The first one was confined to "motor-tricycles assisted by pedalling." There were about six starters, the gold medal being secured by Chas. Jarrott on a De Dion & Bouton tricycle, and the silver medal by P. Richardson, on a similar machine but of English construction. Class two was devoted to "motor-cycles with three or more wheels not assisted by pedalling." There were only about three starters in this class, all on Bollee voituresses, the winner of the gold medal being the Southern Motor Car Co., of Brixton. Class three was devoted to



THE LAWSON MOTOR BICYCLE.

"light motor cars weighing over 400 lbs. but under 1,000, unloaded." There were about six starters, the vehicles being practically all of the popular Benz type, the gold medal being taken by F. O. Seyd, of the International Motor Car Co., Kilburn, and the silver medal by G. D. Barnes. Class four was the one which attracted the most interest and drew the largest number of competitors, it being devoted to "motor-carriages weighing over 1,000 lbs." There was a large number of starters, the vehicles comprising English, French and German Daimler machines, Benz four-seated carriages and Mors carriages. Owing to an adjustment of the time being necessary the winners in this class have not yet been announced. Class five consisted of "motor delivery vans weighing under two tons tare." Three vans started, all fitted with Daimler motors, the winning van being that of Ormiston & Glass, of London, built by the Motor Manufacturing Co., Ltd., of Coventry. This concluded the first part of the programme, which had been carried through in perfect

weather and without any more serious accident than the coming off of one of the driving chains of a carriage.

Cycle chain makers in England are beginning to recognize that the popularization of the motor vehicle is likely to bring them a large increase of work in the not far distant future. So far Brampton & Co., of Birmingham, and Jos. Appleby, Ltd., of the same city, have supplied the greater part of the demand for motor vehicle chains. Now, however, the Albert Eadie Chain Co., Ltd., of Ledditch, are arranging to take up the manufacture of such chains. The first production of the Eadie Co. is a twin-roller chain of one and three-fourths-inch pitch, the rivets, bushes and rollers being all hardened to reduce as much as possible the wear or "stretch," as it is generally termed. A similar departure is also contemplated by Hans Renold, the well-known chain-maker of Manchester.

A new electric vehicle has just made its appearance in Milan, Italy. Few particulars are as yet available but it is understood that the vehicle was built in Paris to the designs of two Italian engineers, Turcinelli and Pezza. The motors and mechanism are built on a standard frame so that any form of carriage body can be fitted. Two motors are provided, one for each of the rear wheels, each working independently of the other. The batteries, which are stated to have a capacity of sixty-two and a half miles on one charge, are arranged under the driver's and passengers' seats. The vehicle has seating accommodation for six persons—four inside and two on the box-seat. The wheels are shod with pneumatic tires. The controller switch is stated to be arranged to give any desired speed between two and eighteen miles an hour.

The Allgemeine Betriebs Gesellschaft fur Motorfahrzeuge is the title of a company which has just been formed at Cologne, Germany, with a capital of \$150,000 to establish public motor-vehicle services in various parts of the country. A company has also just been formed in Berlin with the title of Die Centaur Automobilbau Gesellschaft with a capital stock of \$25,000 to construct motor vehicles.

Premier Motor Vehicle Parts.

The Premier Mfg. Co., Hartford, Conn., were pioneers in the pneumatic buggy business. They are to-day the largest manufacturers of this class of vehicles and parts thereof in the United States. The pneumatic vehicle being only a step in the direction of the motor vehicle they early prepared for the coming of the new vehicle by studying the special features of its construction and producing a line of suitable parts. These parts comprise pneumatic tires, metal hubs, wire wheels, ball bearings and steel rims made of the best materials and representing the experience of several years of study and investigation.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of **THE HORSELESS AGE**, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

COMMUNICATIONS.

Argues for Higher Power.

PEORIA, ILL., May 16, 1899.

Editor HORSELESS AGE:

There is one feature connected with the automobile which, for the good of the business, should be continually dinned into the ears of the public, viz.: high power. It is so common to associate a single horse or at most a team with the ordinary vehicle that we cannot help connecting the idea of one or two horse power with a motor vehicle. This is not a mistake made only by the uninformed and the thoughtless but it extends even to our best engineers. It is aggravated further by the fact that the public demands better and faster service of the mechanical vehicle than it can get from the horse vehicle and this increased demand necessitates a much larger power.

Street railway engineers have been through this experience for ten years or more and are still putting on heavier motors. True they are increasing the sizes of their cars, but on cars of same size much higher powers are used to meet the demands of the public.

The experience of vehicle users abroad is very clearly in this same direction. Higher power, lighter weight and faster speeds are all being demanded.

The writer, like everybody else, knew the difference between a horse and a mechanical motor and made in his early motors what seemed to be sufficient allowance therefor. The common result was found and larger motors used, only to be replaced again with still larger until to-day he is using a 6-h. p. motor in a 700-pound vehicle and does not find it too large or too powerful for many of the conditions which confront it on bad roads or in bad weather.

It is quite probable that still higher powers will be found advisable, if the experience of the French be regarded. Where they formerly had 2, 3 and 4 h. p. they are now using 4, 6, 8 and even more, and when it is remembered that their roads are hard and smooth it can easily be seen that our powers must be heavier.

While it is possible to build a vehicle and equip it with low gear so that a light motor will probably do at a low speed, it is not satisfactory nor salable. The experience of a motor vehicle user, not long ago, fits the case nicely. He said, "When I first received my vehicle it would do about eight miles per hour and I was immensely pleased. This speed was better than the horse could average and the motor never tired. The satisfaction, however, was short until more speed was desired. By reboring the cylinder and changing the gears I manage to coax out sixteen miles per hour under good conditions now, but I wish it was thirty-five." This last wish was expressed with a heartiness which only a man who has enjoyed the pleasure of skimming over a good road, through a beautiful country, can appreciate.

When asked if thirty-five was not stretching the matter a little he replied, "Not at all. When one sees several miles of clean road ahead he enjoys shooting it at the highest speed possible," and this is undoubtedly true. It is a great satisfaction to have ample speed on a stretch of fine road or in a brush with your neighbor's fast trotter.

It is easy to lose one-half your love for the machine if every horseman who comes along can pass you with a smile

of derision. It is also very aggravating to find a bit of mud or a steep hill barring your way and forcing you to turn back. You are constantly haunted by the feeling that the road beyond that hill would have been fine if you had only gotten to it.

The facts to keep in mind, then, are twofold; first, that the horse can exert several horse power for a short time; and second, that the motor is expected to give much better than horse service. On this account a motor, to do the work of a single horse satisfactorily, should be three or four horse power; and to do the work of a team, six or eight horse power. With such power and proper vehicle construction the motor vehicle can traverse horse roads and where they are at all good, will give better speed than is possible with horses.

CHAS. E. DURYEA.

In Favor of the Dos-a-Dos.

PEORIA, ILL., May 13, 1899.

Editor HORSELESS AGE:

Your recent editorial on the dos-a-dos form of vehicle was read with interest, and since we manufacture such a rig in preference to a four passenger vehicle with all seats facing forward, it may interest you and your readers to know our reason for so doing.

We have given this matter much consideration and would not make an unsatisfactory form of vehicle if we knew of a more satisfactory form available.

The writer has probably had as much experience over all varieties of roads as anyone in this country and recognizes very fully how necessary it is to have light weight, high power, simple construction and compact accessible arrangement of the mechanical parts. These and other important considerations demand the best shape for the vehicle.

When you have seen and ridden in vehicles jammed over our rough roads at twenty-five or more miles per hour, you can appreciate the value of low center of gravity and compact, strong construction. The dos-a-dos form gets all the machinery into one bunch with the passenger load immediately over it and this arrangement permits the strongest and shortest form of body. It therefore, most nearly insures the necessary rigidity to the working parts and secures light weight on the steering wheel and heavy load on the traction wheels, so necessary for traction purposes.

To keep the motor in this space and faces forward would necessitate placing the rear seat much higher, making the vehicle more top heavy and the riding much less comfortable at high speeds or else it would necessitate lengthening the body and placing the machinery partly under each seat, a less advantageous arrangement and with greater liability of gases or oils from the machinery reaching the passengers and their clothing.

As for ease or convenience it is a matter of easy proof that two passengers sitting back to back can converse more easily than if face to back with the necessary space between.

We render these vehicles more comfortable by making the seats wider than the box so that the passengers need not sit cramped in place but may swing part way around and assume easy and comfortable positions. The writer has ridden many miles on the rear seat, in this manner, and prefers it to the front seat because it is more sheltered from the force of the wind and affords an opportunity to see things, both front and rear, better than in the front seat.

There is much to be learned about these various questions in their relations to the motor vehicle and we will be pleased to hear from others along this and any other line.

CHARLES E. DURVEA.

Another Bicycle Motor.

SAN DIEGO, Cal., May 15, 1899.

Editor HORSELESS AGE:

After seeing the Butikofer motor bicycle described in your columns I thought I would let you know of my experiments in the same line. I notice that all of the motor bicycles heretofore constructed have been specially built wheels and expensive enough to prohibit the ordinary person from owning one.

I have invented a motor which can be readily attached to an ordinary bicycle and after once being fitted to the frame, can be attached thereto or taken from the wheel in five minutes with no other tools than a screw driver, making it very convenient to use or not as the owner desires.



You will notice also by the accompanying cut that the appearance is also much neater than the specially-built motor bicycle, as the machinery is all encased. It does not interfere with riding with the pedals in case anything should happen to the motor.

The gasoline motor develops one-half horse power, weighs twenty pounds and will climb steep grades.

I have read many accounts of motor tricycles and carriages scaring horses, but horses pay no attention to this machine whatever. I have repeatedly rode past horses within a few feet and they take no notice of it. It makes so little noise that many people I pass never hear it coming. This motor is particularly adapted to carriages and marine purposes, as it can be easily reversed.

Very respectfully yours,

W. E. STEFFEY.

Mr. Skinner Wants a Race First.

BOSTON, May 18, 1899.

Editor HORSELESS AGE:

In reply to Mr. Fischer's letter in your last issue, I am perfectly willing to meet him in a competition for points—manageability, noiselessness, simplicity, appearance, etc.—provided he will first run a race either from Boston to New York, or from New York to Boston. In other words I wish to make the competition conditional upon the race.

Yours truly,

KENNETH A. SKINNER.

To Investigate Liquid Air.

At the request of a number of capitalists President Morton and the faculty of the Stevens Institute, Hoboken, N. J., are making a thorough scientific investigation of recent discoveries in liquid air with a view to determining the actual cost of production, probabilities of cheapening it, methods of handling and uses to which it can economically be put. The main object of the investigation is to ascertain whether liquid air is available for the propulsion of vehicles.

Electric Cabman Arrested.

Jacob German, twenty-six years old, who runs a cab for the Electric Vehicle Co., was arrested Saturday night, charged with running too fast. This is said to be the first arrest for such an offense made in New York City.

A bicycle policeman saw German making twelve miles an hour in Lexington avenue, and, pursuing him, saw him round the corner of Twenty-third street, always a crowded place, at the same speed. The policeman arrested German, who was surprised. The company was notified, and its officers were surprised. German was locked up in the East Twenty-second street station. The rate of speed motor vehicles must not exceed in the city is eight miles an hour between streets and four miles around corners.

The Twyford Motor Vehicle Co.

The organization of the Twyford Motor Vehicle Co., with \$1,000,000 capital, is reported from Pittsburg, Pa. The inventor, R. E. Twyford, is a general contractor, who has been experimenting in this line for several years and is said to have devised a method of applying power to the four wheels of a vehicle which is specially applicable to business and work wagons. The brake acts on all four wheels and the device for compensating is said to show novel features. The inventor's first vehicle has the form of a trap.

Enlargement of the Riker Co.

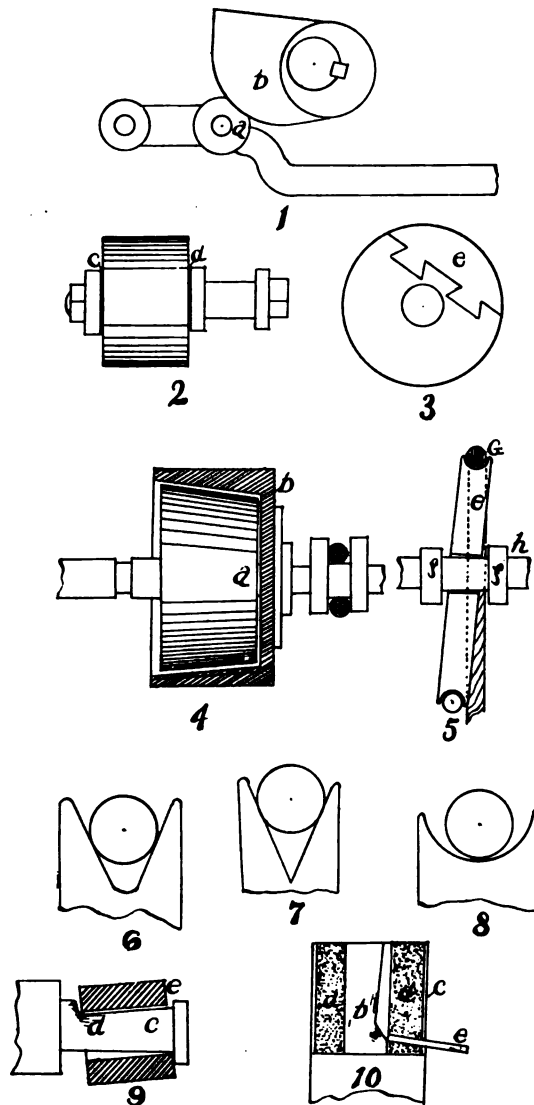
An important deal which will result in a great increase in the facilities of the Riker Electric Motor Co., Brooklyn, N. Y., has just been made. It is currently reported that Oscar T. Crosby and C. A. Lieb, of the Washington Automobile Co., are representatives of the new element.

Boston Automobile Co.

The organization is also reported of the Boston Automobile Manufacturing Co., with a capitalization of \$750,000, divided into \$500,000 seven per cent. cumulative preferred stock, and \$250,000 common stock, both of a par value of \$100 per share. The company is incorporated under the laws of Maine, and will manufacture package delivery wagons, pleasure carriages and cabs, to be run by electric power. The directors are Francis A. Osborn, Joseph B. Moors, D. Webster King, Cyrus G. Beebe and Geo D. Burage.

Motor Vehicle Engineering.

In one case the depressing cam of the cylinder valves of a motor were non-effective, owing to wear. Fig 1 shows the plan of the parts. The cam *b* is shown in its operative position. As the cam revolves it presses down on the roller *a*, and depresses the lever. The makers of the motor calculated that the roller should always be free to turn on its pin. A further investigation showed that the roller was so tight set on its pin, between the flanges, that it bound at *c*, and *d*, Fig. 2, preventing a free revolution, besides retarding the distribution of the oils. The remedy in this case consisted in



setting to work to overhaul the presser cams and rollers. Where a roller was found to be badly worn, as at Fig. 1, it should either be replaced by a new one, or a new piece dovetailed into the roller on the plan shown at *e*, Fig. 3. Then clean all gummed parts and with a steel pointed instrument all oil holes should be opened and cleaned. If the top roll is set directly above the steel one the top roll is very apt, especially when worn, to fall back. Bent steel rolls make irregular work. The only cure is to take them out and straight-

en them. When the flutes of the rolls get worn they are very liable to produce trouble. Refluting of the rolls is the only real remedy for this, but as a rule when the rollers get so worn it will be found far better to throw them out and put in new ones. The weights are very liable to get in the wrong nicks of the levers and bother, if worn.

Gasolene vehicle motors ought to be kept in good, free running condition. The valve shaft running along beneath the engine turns once for every two revolutions of the wheel, hence makes half a revolution for two strokes of the piston. The valves are lifted by cams fastened and revolved by this valve shaft, and each cam has two lips directly opposite each other, each lip lifting the valve at every half-revolution of this shaft, or whole revolution of the engine. When the cam, in revolving, engages with the bottom of the cam lever, the latter is lifted upward and the valve opened. The rapidity of opening decreases as the cam is advanced, and is further decreased by the slow movement of the cam, caused by its making but one revolution to two of the engine. Gummy or any foreign deposits on the bearing surfaces will hinder the free movement of the valves and should be removed. A change may be made in the position of the lever on the vibrating link so that in an oil engine the upstroke may have more power than the down stroke. The block need not slide in a fixed link, but instead a sling link may be used and this move instead of the block, this sling link having an adjustable center, but it is simply a reversal of the method. The objections against this valve gear have been mostly to its mechanical details. To change the travel of the valve makes very little change in compression. The release must come when the eccentric is at an angle of ninety degrees with its center line, if the valve is lapless, and near this angle when it has some exhaust lap. With the angle of advance the same, the eccentric must reach this point at the same time with relation to the crank, hence make no change in exhaust or compression. With a combined change in angular advance and travel the same result must appear, so far as the exhaust is concerned, that came from a change in angular advance alone, since the change in travel does not affect the exhaust, and with an advance of the eccentric the exhaust is earlier and the compression greater as the cut off is shorter, and vice versa.

FRICTION WHEEL.

In some types of motors a friction wheel, of the form in Fig. 4, joined into the shaft, is used. The inner friction wheel (*a*), will at times cling to the half (*b*), and sparking will occur. This is remedied by scraping the leather covered inner friction wheel, and applying to it a dressing of castor oil. The opposite side is then thoroughly cleaned of gummed oil and foreign matter, and, after lubricating the bearings, the wheel is replaced. These friction clutches should be overhauled, scraped and cleaned occasionally.

BANDS.

In some designs of power transmission for vehicle propulsion, bands are used to transmit the power from one shaft to another. Some of the wheels are extremely narrow at the hub, and present so little bearing surface that the strain on the cable forces some of them over to one side. One of these wheels is shown in section in Fig. 5. The narrowness of the hub is indicated at *E*. The pull of the cable tends from the point *G* to *H*, and the side collars could not keep the wheel straight. Wabbling results. These wheels must be removed and substituted by wheels having a hub several inches wider than the original width, after which the former difficulties will

cease. In other systems I have seen the other extreme in the use of wheels of too much bearing surface. Such wheels stand up straight under severe cable strains, but the surplus bearing surface absorbs too much power.

BANDS TOO SMALL.

Often the bands are so small and so little of the groove is presented to the sides of the band that slipping results. Such a combination is shown in Fig. 6. Again, it may be that the grooves are too small, so that the cables ride partly upon the edges, as in Fig. 7. Sometimes large, rounded grooves and small bands as in Fig. 8 are used, and as the band cannot get a grip, slipping results.

WORN BEARINGS.

The process of rectifying a worn bearing in a motor is shown in Figs. 9 and 10. The best plan is to use V-shaped grooved wheels, in which the bands will fit evenly and get a good grip without binding. Fig. 9 is a drawing of the condition in which one of the bearings of a motor shaft was recently found. The end c was so badly worn at d that the box cap of the adjusting journal settled down to e. The shaft was removed and fitted up with a casting box c, as in Fig. 10. This box was filled with sand, forming a mold for the new end b. The sides were packed with sand d, and then hot metal was poured into the mold at g and permitted to run out at e, until the worn end was heated red. Then the outlet e was plugged and the hot metal again poured until the mold was filled to the end. This was cooled, forming a new end over the stub of the worn one, the same size as the original, and placed in the motor.

QUESTIONS AND ANSWERS.

At the request of many of our readers we have decided to open a department of questions and answers. We will endeavor to answer any detail question in practical engineering pertaining to motor vehicles.

Where, Oh Where—If Not Here?

CAPE TOWN, SO. AFRICA, April 24, 1899.

Editor HORSELESS AGE:

We trust you will pardon us for trespassing on your valuable time, but we are ignorant upon a certain question, and as an editor is supposed to know everything, we venture to ask you to stop a minute on your flight through the air on your "no horsey no muley" vehicles and tell us where we can get for some of our customers a horseless carriage that will carry under any and all circumstances as many as twelve people through the air at a mild rate of speed, and be able to do it every day of the year.

The roads are rough and pneumatic tires are wanted to take off the jar as they come down.

A few made in Germany are running here now but they are at the shops one-half the time, and while it pays the shops it is hard on the owner.

Our desire is to see some of these machines running on the streets made in the United States of America.

Can you help us?

Yours very truly,

COLONIAL-AMERICAN IMPORTING CO.,

Per A. H. Mason.

Exclusive Licenses or Franchises.

PAWTUCKET, R. I., May 17, 1899.

Editor HORSELESS AGE:

I am interested to learn if any franchise, exclusive or otherwise, has been granted to any individuals or corporations for operating motors for vehicles on the streets of cities or towns. If such licenses have been granted I should like to know to whom, and further whom to address to procure copies of such licenses. Any information that you can give me on this subject will be greatly appreciated.

Yours very truly,

UNITED STATES AUTOMOBILE CO.,

Frank Mossberg, Pres.

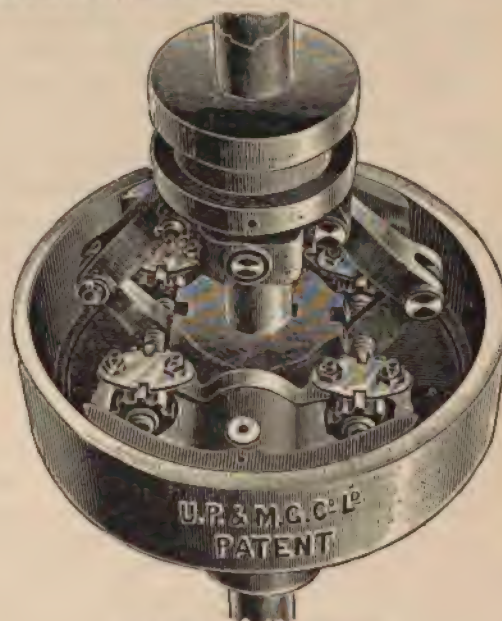
Answer to James B. Woolson:

In reply to this question it can be stated that the compression space varies from forty to twenty-three per cent. of volume swept by the piston. In late years the tendency has been to increase compression, which shows a marked gain in economy. It is hardly safe to make the compression-space less than twenty-five per cent. of volume swept by the piston as the charge is apt to be fired prematurely by the heat produced by high compression. For motor vehicle use a moderate compression is usually taken, as a high compression means a heavy fly-wheel, more vibration and a sharper and more penetrating exhaust.

CHARLES B. KING.

A New Friction Clutch.

The *Autocar* gives a cut and description of a new friction clutch, made by the Unbreakable Pulley Co., which is said to be available for motor vehicle work.



A NEW FRICTION CLUTCH.

Ernest Ofeldt, the launch manufacturer of South Brooklyn, N. Y., has perfected his steam carriage, and is running it about the adjacent country.

MACHINERY and TOOLS *for* **motor vehicle builders**

Readers using information from this department are requested to give credit

The Whiton Universal Automatic Gear Cutting Machine.

Gear cutting is an important branch of work in the average motor vehicle factory. Not only must different kinds of gears be used in the construction of a motor vehicle, but these gears must be accurately and uniformly cut or noise and unnecessary friction will result. Several machines for doing this work have been designed of late in this country, some of them operating entirely on the automatic principle. Of these latter machines there is one which commends itself particularly to the builder of motor vehicles, because of the wide range of work it will perform, its adaptation to the medium grade of work such as is required for motor vehicles and the ease with which the necessary changes can be made.

The general design of the machine is the most satisfactory for a wide variety of ordinary work. The blanks are mounted upon a vertical work spindle, and the cutter carriage slides in a vertical or inclined path as required. Both the cutter and the work performed may be readily inspected at any point in the cutter travel. The work spindle is adjusted toward or from the cutter to accommodate variations in diameter, and clamped at the desired point. It is hollow and of such shape that chucks or special fixtures for holding the work may be readily fitted. The frame is a single rigid casting, very heavy in all cross sections, and accurately finished. All the parts are well proportioned, and have the largest possible wearing surfaces.

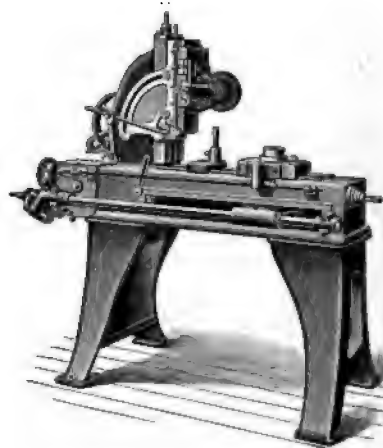
Power is conveyed from the fixed driving shaft through miter gears, a sliding splined shaft, and bevel gearing, pivoted in the cutter carriage concentric with the cutter spindle. A sliding yoke holds the journals of the splined shaft in perfect alignment, relieving them of all side thrust. The connections are such as to accommodate any possible position of the cutter carriage. The cutter spindle is mounted in a transversely sliding box, which may be adjusted as required in setting the various cutters to coincide with the enter of the dividing spindle.

The cutter carriage or slider is moved by a feed screw mounted in the cutter support. This feed screw is driven from the pivoted shaft, about the bushings for which the cutter supporting frame may be adjusted to any required angle, one of the side arcs being graduated for this purpose. After setting, this support may be clamped rigidly at the necessary angle for bevel gear cutting. The pivotal shaft is driven through spiral gearing by a splined vertical shaft accommodating any desired vertical position of the head, this vertical shaft in turn being driven by a horizontal shaft mounted in the frame of the machine. The direction of movement of the cutter carriage is controlled by a sliding clutch upon this horizontal shaft, the quick return movement being at a constant velocity while the feed may be varied

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VOL. 4, No. 2, May

widely by the use of such change gears as may be found best in practice. The horizontal driving shaft is also provided with an independent clutch controlled by the hand lever shown at the front of the machine, by means of which the feed mechanism may be connected or disconnected, as desired. The sliding or reversing clutch may also be moved to the central position, out of engagement with either of its drivers, whenever required. With the sliding clutch in this neutral position, or the feed mechanism disconnected by the cut-off clutch referred to, the cutter carriage may be moved in either direction by hand, by applying the crank handle to the projecting end of the pivotal shaft. The machine may be conveniently fed by hand, if desired, in setting for depth of cut, etc.



The clutch through which the feed shaft is driven in either direction is moved mechanically into contact with its opposite drivers. By so controlling its action, the successive steps in the operation of the machine are made to depend upon the completion of all previous movements. The clutch movements are accomplished by a rock shaft, gear segment, and a rack on the clutch slider.

The required divisions are accomplished by a worm gear, worm, and suitable change wheels. The worm gear is divided in the center and the parts are hobbled successively in different positions until practical accuracy is attained. Suitable provision is made for taking up any wear which may occur between the worm and worm gear.

The spacing mechanism is driven at the proper time by a positive clutch which does not require adjustment or consume power when not in action. It is started and stopped by a notched disc within the spacing box, moved through a pawl and ratchet connection by the rock shaft which controls the reversing clutch.

Cone gearing between the initial shaft and the cam shaft is provided so that the number of initial revolutions to be allowed before the cam shall act to stop them, may be varied as required.

The gear train which connects the spacing clutch driver and the driving shaft is made of the same ratio as that connecting the driving shaft and the cutter spindle, so that the spacing shaft and cutter revolve in unison. A hand lever is provided by which the initial spacing shaft may be started, independently of the rock shaft and reversing clutch action, so that continuous revolution of this spacing shaft in unison with the cutter may be availed of to automatically cut worm gears by the hobbing process.

The driving gear of the spacing train is mounted on an adjustable clamp coupling provided with a graduated ring, so arranged that by releasing the clamping bolts the worm shaft and spacing train may be revolved independently of the spacing shaft, the amount of such movement being easily registered by the graduated ring. This arrangement provides convenient means for setting the blank for the second cut in bevel gear work.

The dividing or work spindle is provided with an adjustable graduated collar, having a notch into which, in one position, a spring pressed plunger may advance. This plunger is connected by suitable mechanism with a ratchet guard in the spacing box, which, when the plunger is advanced, will prevent the engagement of the pawl and ratchet of the spacing mechanism above referred to, so that the No. 2 movement of the rock shaft will not move the stop disc, and spacing will not occur. The graduated spindle collar may be set so that the plunger will advance upon the completion of the whole, or of any desired part of a revolution of the work spindle. The movement of the plunger and its connections also moves a bell hammer into the path of a cam, so that upon the completion of the desired series of gear teeth a continuous alarm is rung. A clamping screw is provided, by means of which the alarm mechanism may be prevented from acting, if desired.

MINOR MENTION.

Pasadena, Cal., is to have public motor vehicles next season.

Robert Laird, electrician, Hanford, Cal., is said to be building an electric vehicle.

A motorman was arrested in Philadelphia one evening last week for running his vehicle without a light.

The Archibald Wheel Co., Lawrence, Mass., are making wheels for the Columbia Automobile Co., and the Woods Motor Vehicle Co.

Edward S. Clark, 272 Freeport street, Boston, Mass., is building the engines and boilers for the omnibuses which the National Transportation Co. are to put in service in the suburbs of Boston.

Major R. P. Davidson, of Highland Park, Ill., has been in correspondence with the Duryea Mfg. Co., Peoria, Ill., for the purpose of arranging with them to build a motor gun carriage, but the Duryea Co. report that they have not the time to undertake any experiments in this line.

Inventor Skerry, whose steam carriage was illustrated in our issue of April 12th, is endeavoring to organize a company with \$300,000 capital at Hartford, Conn., to manufacture this and other kinds of vehicles. The company would be licensed by the New England Motor Carriage Co., of Boston, Mass.

The Whitney Manufacturing Co., Hartford, Conn., are preparing to adapt their "Wizard" chain to motor vehicles, for which they claim it has many advantages. The teeth are on the chain and not on the sprocket, which has rollers with openings between so that the dirt drops through. For a given pitch it is said to have fewer parts, and while an ordinary chain climbs the sprocket or is liable to break when lengthened, the "Wizard" is not, but always finds its place on the sprocket no matter how much it lengthens. Nor will it shorten in mud and water, and even if out of pitch and out of line it will run smoothly.

There is talk of a line of motor 'buses between Troy and Albany, N. Y.

J. A. Jenney, New Bedford, Mass., has invented a compressed air carriage.

The Philadelphia Park Board is still considering the question of admitting motor vehicles to the parks.

The Eaton Motor Carriage Co., Boston, Mass., are building several electric carriages for London customers.

The United States Automobile Co., Attleboro, Mass., are about to erect a factory for the production of electric carriages.

A bill for the regulation of motor vehicles used for public purposes is to come before the Massachusetts Legislature next January.

The compressed air carriage which is being constructed by Jeremiah Haley and others at 34 Elm street, Hartford, Conn., is about completed.

The American Roller Bearing Co., Boston, Mass., are having a test of their bearings made on the cabs of the Electric Vehicle Co., New York.

The Studebaker Mfg. Co., South Bend, Ind., are reported about to manufacture electric omnibuses to convey passengers from the railroad depots of Chicago to the Studebaker theatre.

The \$5,000 lunch wagon which T. H. Buckley & Co., of Worcester, Mass., exhibited at the World's Fair, Chicago, will, it is said, be fitted with a compressed air motor and sent to the Paris Exposition of 1900.

The Still Motor Co. has been organized at Toronto, Canada, to manufacture, sell, operate, rent, etc., all kinds of motors and motor vehicles. The directors are W. J. Still, Thos. Bengough, L. W. Doring, C. W. Chadwick and Jos. Heighington.

The Canda Mfg. Co., Carteret, N. J., are bringing out a wagonette seating six persons. The Canda Co., it will be remembered, purchased from the Duryea Motor Wagon Co. the exclusive right to make certain types of vehicles under the Duryea patents.

The Electric Storage Battery Co., Philadelphia, Pa., has obtained an injunction against the Hatch Storage Battery Co., Boston, Mass., which had been manufacturing storage batteries for about two years and supplying them to New England trolley companies. The effect of the decision is to strengthen the monopoly of the Storage Battery Co.

The Electric Automobile Supply and Mfg. Co. was recently incorporated in New Jersey with a capital of \$100,000. The incorporators are Chas. P. Scott, of New York City, and Frederick K. Easton and Edgar J. Runyon, of Elizabeth, N. J. The office of the company, which will make fittings and supplies for electric motor vehicle manufacturers, is at 269 Market street, Newark, N. J.

W. S. Rogers, manager of the Ball Bearing Co., Boston, Mass., has made arrangements to build a number of carriages using his transmission, which was illustrated and described in our columns recently. They will be constructed at Troy, N. Y., and the power employed will be gasoline. Mr. Rogers states that the strong features of his device are its durability and low cost of production. The first carriage is to be finished in July.

MOTOR VEHICLE PATENTS

of the world

No. 624,689—Motor Vehicle—Wilton Summer Schuyler, Oceanside, Cal. Application filed April 1, 1898.

One object of this invention is to so arrange a motor vehicle that the motor and all the heavy mechanism may be carried on a spring-supported bed, so as to avoid the loss of power and the strain upon the machinery caused by having the motor and its mechanism arranged upon a bed unyieldingly attached to the running-gears of the vehicle.

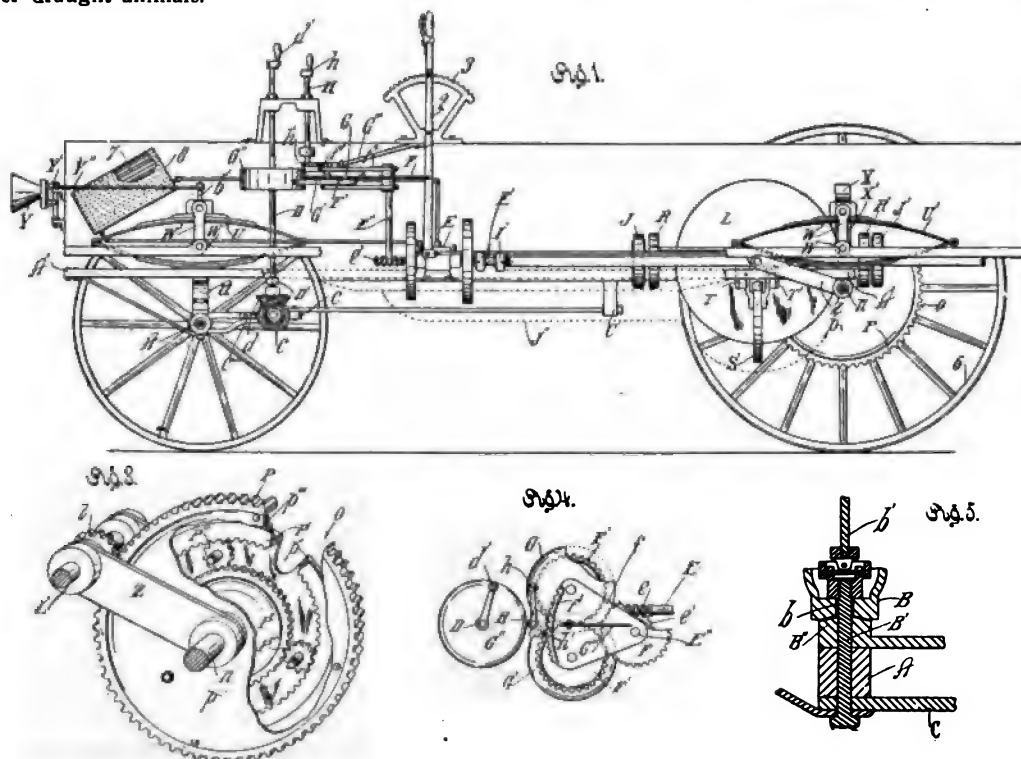
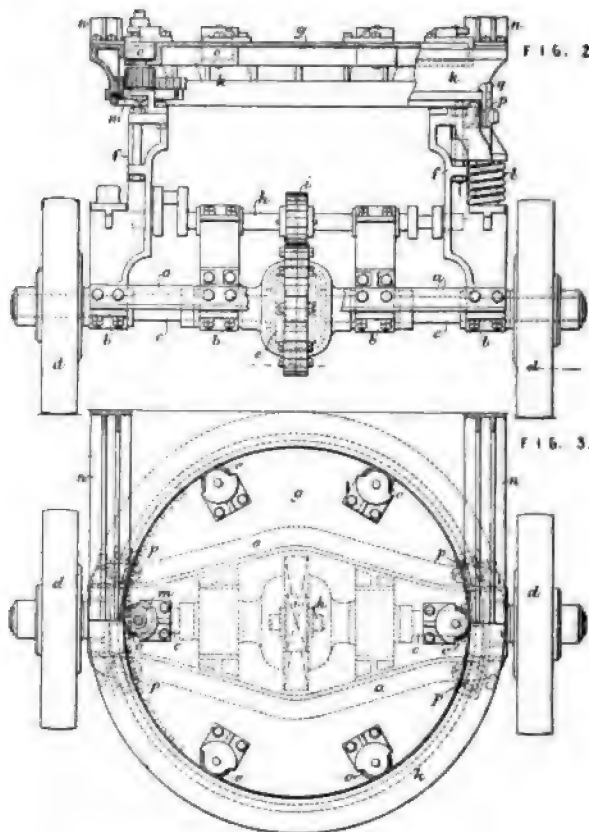
Other objects are to provide means whereby a motor vehicle capable of satisfactory general use may be produced without the use of pneumatic tires and to provide improved means for steering the vehicle, that can be operated by power from the motor or by hand-power, as desired, thus adapting the invention for use on heavy trucks as well as light vehicles.

British Patents.

Improvements in Motor Cars—Jean Molas, 247 High Road, Queen Anne's avenue, South Tottenham, County of Middlesex, England.

This invention relates to a motor vehicle, propelled by an engine of any suitable kind or by an electric motor, so arranged that it can operate as a tractor, being attached to an omnibus or other suitable vehicle so as to take the place of horses or other draught animals.

Fig. 2 is a front view partly in section, Fig. 3 is a plan; a is the underframe which has four bearings b, two for each of the axles c of the driving wheels d, these two axles being connected through a differential gear c of ordinary kind.



MOTOR VEHICLE OF W. S. SCHUYLER.

At each end of the underframe a is a pedestal f which supports a circular platform g for the driver. In the pedestals f are bearings for the ends of the shaft h, which may be a crank shaft having a pair of cranks worked by a pair of engines, or may be the shaft of an electric motor without cranks, the engines or motor being carried by the platform g. On the middle of this shaft is fixed a pinion i which gears with teeth on the periphery of the box which encloses the differential gear, and has bearings for the bevel-pinions. A ring k is carried on springs l; resting on the pedestal f, and has part of its internal circumference toothed to gear with a pinion m on a vertical steering shaft. The ring k is attached by angle brackets n to the front of the omnibus or vehicle which it is intended to draw. Rollers o p serve to guide the platform g horizontally and vertically as it revolves within the ring k, when the pinion i is turned for the purpose of steering. On the axis of the rollers p are hooks q which engage over a rib projecting from the ring k and prevent it from leaving the roller bed.

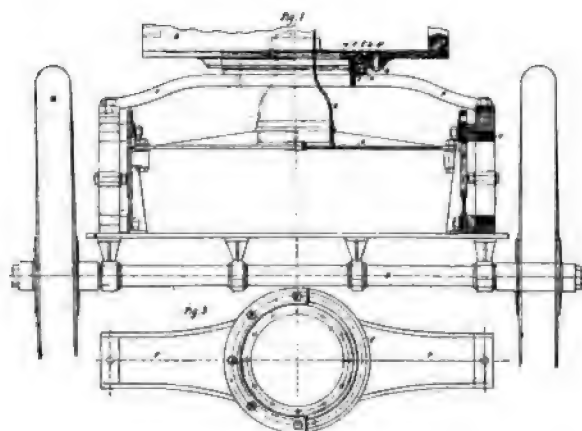
Improvements in Motor Road Vehicles, Pope Manufacturing Co., Hartford, Conn.

This patent refers to the tricycle delivery or carrier, the United States patent on which was described in THE HORSELESS AGE of April 12.

No. 4249—A new system of joint between the axle and body of a carriage, especially applicable to motor vehicles. Alphonse Blot, Paris, France. Application filed February 25, 1899.

The invention relates to a new system for construction of the joint, which enables the underframe to turn with regard to the body.

This joint is now made by aid of a vertical axle designated a joint-bolt. This joint-bolt is dispensed with and the joining is effected by an annular joint which lets pass through its center a fixed or movable column on which are placed all the constituent parts for driving the motor and steerage.



The part to the left of Fig. 1 is an elevation, the part to the right a vertical section following the axis of the annular joint. Fig. 2 is a plan. A is the coupling of the body, R R' are the wheels and B the axle of the movable fore-carriage which comprises the suspension springs C and other accessories.

The bridge or yoke F fixed to the fore-carriage by the extremities of its arms is arranged so as to form in its center one of the parts of an annular ball joint. f, f' is a crown forming jaws of which the lower part f, which is made in

one piece with the yoke F constitutes a basin for the first row of balls b; the top part f', joined by means of bolts or screws v to the lower part f forms a retaining cap for a second row of balls b'. A ring a is fixed by bands or a collar a' and by aid of bolts a' to the body A, it fits between the jaws f f' of the crown and is hollowed on the higher and lower side so as to constitute a rolling surface for balls b' and a surface resting on balls b. Rings c c' moving with the balls may serve to preserve the spacing of these balls and thus dispense with the use of a continuous crown of balls.

In the plan of Fig. 2 we have supposed the body, ring a, and top part f' of the joining crown to be removed. The part on the left represents the balls b and ring c moving with these last and preserving their spacing. This ring is broken in order to show on the part to the right the rolling surface constituted by the lower part f of the crown. A simple inspection of the figure gives an idea of the mobility of the body with regard to the fore-carriage.

This style of joint which may seem more complicated than the joint-bolt hitherto employed allows all the controlling organs of the motor and for steering to be placed on a fixed or movable column E, running in the hollow center of the joint. D is a cross-bar fixed by its ends to the fore-carriage and acting as a supporting stay for the column E.

It is evident that instead of placing the crown with jaws f f' on the yoke F the ring a being fixed to the body the arrangement is reversed by fixing ring a to the yoke and the crown with jaws to the body.

No. 4058—Improvements in Driving Mechanism for Automobiles and the Like. The Kolner Accumulatoren-Werke Gottfried Hagen, Kalk, near Cologne, Germany. Application filed February 23, 1899.

This invention relates to a driving mechanism for motor vehicles in which the motor is connected rigidly or on springs with the car body and drives by means of belts, chains or the like the driving axle which cannot share in this spring action.

The arrangement has for its object the influencing of the tension of the belts by means of springs in such a way that in spite of all the joltings or oscillations of the car body, not only does the belt remain constantly taut, but elongations of the belt are compensated for, and too great strains on the belt and overloading of the motor by alternations of speed in the same or impediments in the way of the car are avoided.

In the present invention this is attained by the arrangement of a peculiar flexible or hinged four-cornered figure which has two spring sides situated opposite one another and two rigid ones and also a rigid diagonal.

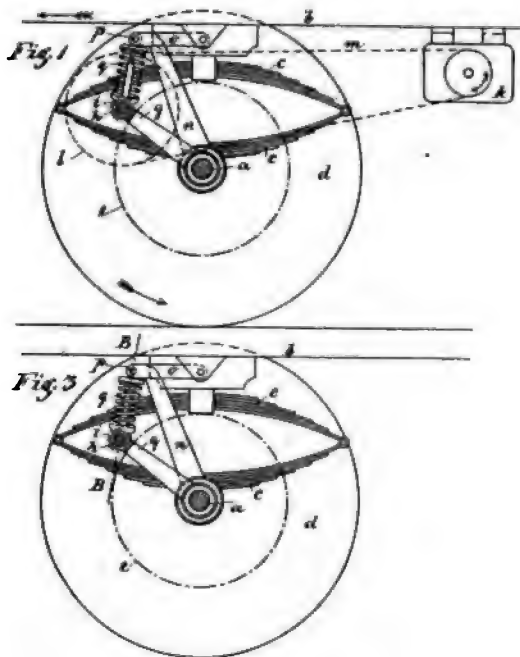
Fig. 1 is a mainly diagrammatic representation of this improved driving apparatus in side view.

Fig. 2 a front view of same partly in section.

Fig. 3 a section on the line A A of Fig. 2.

Fig. 4 a section on the line B B of Fig. 3.

The wheel axle a carries springs c supporting the car body b. On the end of the axle the car wheels d and the cog wheels e firmly connected therewith are mounted so as to be freely revoluble. The axle a is also enclosed by two sleeves i which can also freely rotate on it and in the arms g of which the shafts h of the pinions i engaging with the cog wheels e are mounted. In order that both wheels d may rotate independently one of the other, the shafts h are driven by means of differential gearing l from a motor k firmly connected with the car body b, which gearing is only shown diagrammatically in the drawing and is at the same time assumed to consist of a belt pulley for the belt m.



As shown in Fig. 1 the shaft h can revolve in a circle round the shaft a as both are connected with one another by the arms g. The pinions i can thus never come out of engagement with the cog wheels e. In order to keep the belt or chain m always correctly taut, the following arrangement is adopted.

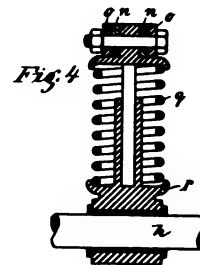
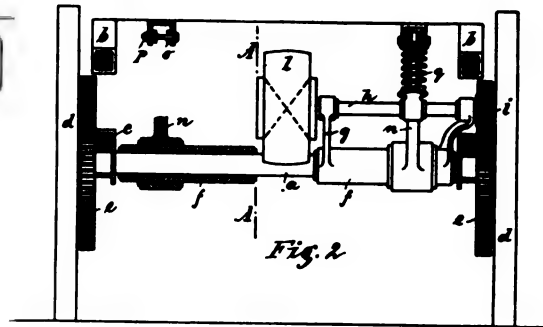
Over the sleeve f on each side a freely revoluble arm n is placed which is pivotally connected with the underframe of the car by links o carrying a bolt p. On this bolt p a spring q engages, the other end of which is received by a holder or sleeve r placed on the shaft h (Fig. 4) and freely revoluble thereon.

The arm g, spring q, link o and spring c thus form a flexible four-cornered figure, one diagonal of which is formed of the rigid arm n. This four-cornered figure is attached by one corner to the wheel axle a and with an adjacent one to the under frame of the carriage. Between the two other corners is located the spring q which controls the tension of the belt. Instead of the links o any other like vertical guide may of course be employed.

On the motor being started and also at each increase in the speed the spring q is first compressed and thus produces a slight slackening of the belt m and consequently a transmission free from jerk. The same takes place if the car when running suddenly encounters obstructions, like gutter stones (channel stones) or short extraordinary steep gradients and the like. The slackening of the belt admits of the same slipping slightly and thereby avoids overloading the motor in the most effective manner.

If, where electric motors are used, the motor is also to be utilized as a brake the spring q yields when the brake is applied and the belt is stretched more strongly. By this means slipping is avoided.

Where benzine or petroleum motors are employed several step pulleys may be arranged on the gear shaft in order to allow different speeds. The spring mounting of the gear shaft in this case also allows a slight slipping of the belt in the event of sudden changes in the load, or of overloading the motor and there is therefore no reason to fear the motor's stopping by reason of overloading.



In the drawing it is assumed that the motor and gear shaft are arranged on different sides of the driving axle but they may be both placed on the same side with a suitable arrangement of the spring q.

It is also not necessary that there be only one motor as shown in the drawings, acting on a differential gear arranged as a belt pulley but a separate motor may be provided for each wheel so that the two may revolve independently one of the other.

Roots' Kerosene Motor Vehicle.

In August, 1895, the author, conjointly with his partner, Mr. Venables, commenced the construction of the first motor-carriage propelled by a petroleum motor made in this country. There had been small and light vehicles of the tricycle type, such as those which have been described, built before, but none, so far as the author is aware, with a carriage body of ordinary construction. This vehicle was fitted with a vertical oil motor on the Roots principle of vaporization and feeding of oil, and was of two and three-fourths brake horse power and of three and a half indicated horse power. The method of steering is the cycle head and fork, with the addition of a heavy coil spring fitted inside the head, which permitted the fork spindle to slide vertically within the head. When the carriage was first tried in February of 1896, the motor had a friction clutch or drive attached to the crank shaft, so adjusted that if more resistance than the equivalent of two and three-fourths brake horse power were placed upon the clutch it would automatically slip. In practice, this slip only took place when starting, when changing speed from slow to quick, and when on the steepest hills. A chain from the friction clutch drove the outer casing of a box of gear providing two speeds, a maximum of eleven and a slow speed of four miles an hour. It was first tried with a speed of thirteen miles an hour, but the side slip or skidding of the single front steering wheel made the steering, when going at this speed on a greasy road, very erratic and even dangerous. The reduction to eleven miles an hour, together with the addition of weight over the steering wheel, completely sur-

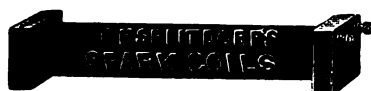
mounted this difficulty. The weight of the car was about 13 cwt.

About eighteen gallons of water were carried in a tank beneath the floor of the car. A large copper cooling coil was placed in front of the petro-car behind the louvre slats. The water was pumped through the jacket round the coil and into the tank. The governing was effected by an inertia governor operating upon the exhaust valve and the oil feed. This was not found to be perfectly satisfactory, because the dropping of the vehicle wheel in a depression in the road or going over an obstruction would act upon the weight of the governor, throwing it out of position when not at excess speed, so that a rough road would sometimes slow down the motor. The body had ordinary plate springs to attach it to the frame, while the frame rode upon coiled springs fitted to blocks sliding in guides, in a similar way to tram-car springs.

The box of gear for changing speed was not found to be very satisfactory, and early in 1896 this was taken off, and the transmission effected by belting and toothed wheels. Two pulleys were fitted to the crank-shaft and two others on a countershaft, the bearings of which were fitted to the same slide block moving vertically in guides which carried the ball bearings for the axle, so that the centers of the two shafts were always relatively at the same distance from each other. A large gear wheel on the axle geared always with and was driven by a small pinion on the countershaft. The straps connecting the crank-shaft pulleys with the countershaft pulleys were both normally loose, and whichever speed it was desired to use, one of two jockey pulleys tightened the one strap and still further slackened the other.

The motor used on this vehicle was a single-cylinder vertical motor of very simple construction. The cylinder was five and one-fourth-inch diameter and six-inch stroke, and was tested frequently in the shop before fixing to the vehicle frame. It gave about 2.75 horse power on the brake at 400 revolutions, and ran with great steadiness and freedom from smoke or smell. It required some months of the closest attention and labor to make it run in the same way on the car. No doubt the power was the same, but the vibration of the vehicle, and the giving of the springs, affected the accuracy of the measurement of the oil feed, and in this way prevented that perfect combustion in the motor which was obtainable when bolted to a solid foundation. The most careful attention and adjustment also were required to make the inertia governor behave in about the same way on the vehicle as when working stationary. These difficulties were, however, surmounted, and the vehicle ran very successfully for two years, and covered some thousands of miles. From the running of this carriage, the author came to the conclusion that rather less vibration would be caused by a horizontal motor than by a vertical one, which opinion was afterwards justified in his adoption of the horizontal form.—*From a Lecture by J. D. Roots Before the Self-Propelled Traffic Association of Liverpool, England.*

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NUMBER 9

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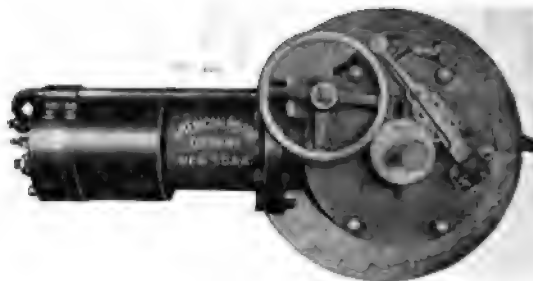
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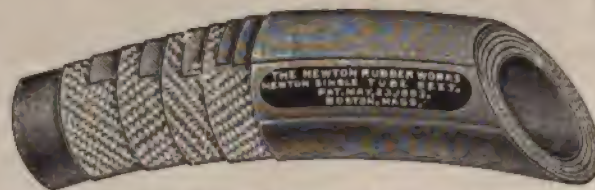
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VOL. IV.

NEW YORK, MAY 31, 1899.

No. 9.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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Road Racing.

The 700 mile dash of Alexander Winton last week from Cleveland to New York has revived the question of road races in the United States, and set the light-headed element who regard the motor vehicle industry as a mere development of the bicycle industry agog with excitement. If the new industry is to be established here, we are advised, road races must be held to influence capital and demonstrate to the American people the capabilities of the motor vehicle. The "hurrah boys" of the bicycle trade, with its shallow enthusiasm, its shortsightedness and its slump, is to be introduced into the motor vehicle trade to give it "go," and the old fogies who now regard motor races as they do horse races—a sport which certain idle or vicious classes may indulge in on their own preserves—are to be relegated to the rear.

Fortunately, the motor vehicle business is something more than boys' play. The task which the advocates of the motor

have set for themselves is pre-eminently a practical one—namely, the substitution of the motor for the horse in the world's work—and the mechanical and commercial problems involved are of a nature to demand men of maturity and not boys for their solution. As to the purchasers of motor vehicles, the great majority are chiefly interested in the economical side of the subject, which is about as closely related to road racing as it is to football, baseball or rowing.

But let us treat this question in its relation to conditions as they exist in the United States to-day. The advocates of road races here point to the road contests in France as proof of the benefits to be derived from this source, forgetful of the difference in the conditions. The early road races in France were no doubt of great value to the struggling industry. At that time something sensational was needed to draw the attention of the world to the motor vehicle. Road races, with their unheard of performances, furnished the sensational feature for the press and gave to inventors and manufacturers an opportunity of testing their handiwork under extreme stress, and hence were, for the time being, justified. But even in France the situation has changed entirely. The speeds attained in the contests have been gradually increased until fatal accidents are common, and the bad example set has been so universally followed by other users that the motor vehicle has become a menace to the public safety. The advertising feature is no longer needed, because the whole nation has become familiarized with the merits of the motor vehicle. Manufacturers have every opportunity of testing their machines on the road without the dangers and disasters of the race. The Automobile Club itself, which originated the great road contests in France, has come to the conclusion that they have outlived their usefulness, and has turned its attention to practical tests, designed to encourage the commercial development of the motor vehicle.

If this is true of France, how much more true of America! The results of the French races are well known here. Through the dailies and the technical press the public has been well informed of the capabilities of the motor. No such

conditions obtain here as four or five years ago necessitated the organization of road races in France. The cable, the telegraph and the printing press have made the civilized nations one.

There is another, and very important reason why road races are not wanted here, and that is our execrable roads. Mr. Winton discovered this on his recent run to New York. No machine can be built strong enough to stand the highest speeds on American country roads. The shocks and strains set up are so severe as to increase the danger of the race a hundred fold. The accident which occurred to Mr. Winton at Fairport is generally ascribed to a flaw in the axle. This need not have been the case. The nature of the obstacle and the high speed of the vehicle are sufficient to account for the breakage without any such supposition. The occupants of the carriage may congratulate themselves on their escape from death or serious injury. That their enthusiasm was somewhat dampened by the terrible shaking up they received, is seen in the slower time made during the remainder of the journey, and in Mr. Winton's statement that we want no road races here while our roads are in such deplorable condition. If we do not want them now we certainly will not want them in the future era of universal good roads, for reasons hereinbefore given.

Now, as to the opportunity road races afford a manufacturer of testing his machines. Suitable tests can just as well be made in private, and in very many cases it would be much better for the manufacturers' reputation if public tests were avoided. A large number of the defects revealed by these road contests could have been foreseen and prevented by good theoretical engineering in the factory. Road work is essential to the perfection of a motor vehicle, but so is engineering, and the tendency has been to rush into the road work and omit the engineering.

At best the time which can be made on our roads compares very unfavorably with the records made on the beautiful roads of France, and therefore has a disparaging effect on the American motor vehicle. The public do not think of the handicap, looking at the results alone.

Last, but not least, is the nuisance created by monopolizing the public highways and putting a stop to the world's ordinary business for the sake of indulging in a cruel and dangerous sport (if road racing is to be allowed the participants must, of course, have the right of way), and the false precedent established for ordinary users, especially the young and thoughtless, who will be running amuck at the peril of the community. Then again, when we are in a hurry to reach a distant destination, we will take the railway train whenever we can, and not the motor carriage.

Much mischief has already been done in the United States as well as in France and England by enthusiastic inventors and experts who are accustomed to run their vehicles in settled communities at from fifteen to thirty miles an hour,

and who advocate such speeds for general use, forgetting that they are more experienced in the handling of their own vehicles than their customers can ever be, and that as motor vehicles multiply in the streets the dangers of excessive speeds will grow in greater ratio. At Newton, Mass., the home of the Stanley steam carriage, the city authorities have fixed the limit for motor vehicles at ten miles an hour, notwithstanding the fact that on some of the beautiful boulevards that make this suburb of Boston famous, speeds of fifteen to eighteen miles an hour might safely be allowed. At Cleveland similar action has been taken by the City Council, and many other municipalities are giving the matter attention. The result is likely to be a ten mile maximum for motor vehicles in cities. Leading manufacturers are cutting down the speed of their vehicles to a maximum of twelve to fifteen miles an hour in order to avoid trouble for their customers.

In the face of these facts talk about motor road races in the United States is sheer folly. The editor of *THE HORSELESS AGE* has been from the start, and is still, unalterably opposed to them, and hopes that for the sake of the industry they will be prohibited by the authorities.

Carbonic Acid Motors.

It is with sincere pleasure that we lay before our readers in this issue a superficial account of the carbonic acid carriage of C. D. P. Gibson, of Jersey City, a mechanical engineer of recognized ability, who has devoted four years to the study of the motor problem, and has built two carriages, the first using steam as a motive power and the second employing that most alluring and elusive motive agent—carbonic acid, which leading inventors of the world have vainly puzzled over for the past two or three decades.

The expansive power of carbonic acid is titanic, but two chief difficulties have stood in the way of its adoption for power purposes—the inability of inventors to control it and prevent the valves of the engine from freezing up owing to its too rapid expansion, and the high cost of the substance. The second difficulty may perhaps be largely due to the first, for until the gas has been successfully controlled its cheap production is not of prime importance.

In point of size and power the Gibson carbonic acid engine is certainly a marvel, and so far as the editor could judge from his limited knowledge of such subjects the freezing up of the valves has been entirely obviated. If this is so, and the acid can be manufactured on a large scale at \$3 a ton, as claimed, then another power has entered the field to compete for urban work, a motive agent having tremendous reserve energy, and admirably adapted for trucking and other heavy drudgery.

M. Charron Challenges.

According to the New York *Herald* M. Charron, winner of the last road race in France by an average speed of thirty miles an hour, issues a challenge to Alexander Winton or the world to run him a race, either in France or America, for any purse between 5,000 and 100,000 francs. We are curious to know what French racing machine M. Charron would select for a race over our country roads. Neither the French builders of motor vehicles nor M. Charron himself realize what those roads are, nor have they any machine that is adapted to such punishment.

But the road racing lunacy is evidently threatening us, and prompt action is needed to prevent its spread.

Clogging of Boilers.

The opinions expressed by two leading manufacturers of light steam vehicles in regard to the liability of their boilers to encrust and clog are not accepted by many authorities on steam engineering, who claim that provision for cleaning these boilers should always be made. M. Serpollet, the French steam specialist, is said to have made such provision in his new vehicle and thus overcome the chief obstacle to their practical use. A boiler which cannot be cleaned is, of course, useless once clogged, and would have to be replaced by a new one.

It remains to be seen whether these small steam boilers will be as free from this fault as the makers claim.

Kerosene Motors.

As a fuel for vehicle motors kerosene has some advantages. It is obtainable everywhere, is cheaper than gasoline and not so inflammable. It has also disadvantages, chief of which are the disagreeable odor of the exhaust, the deposition of residue on the working parts and the odor, strong and lasting as that of the stable, which clings to one who handles it.

While something may be done to purify the exhaust, kerosene is so much richer in carbon than gasoline that complete combustion is not likely to be obtained, unless the oil can be refined or separated in some apparatus connected with the motor. The second objection could be overcome by arranging the parts affected so that they could be cleaned occasionally. As for the third objection, this appears to be insuperable. Hence, at present kerosene motors would appear to be limited to the country districts solely on account of the rankness of the exhaust.

Where are the Sixty?

In his address at the annual meeting of the Automobile Club of France, Baron Zuylen de Nyevelt, the president, stated that there were 600 builders of motor vehicles in France, 110 in England, 80 in Germany and 60 in the United States. If the Baron's figures for France are no more reliable than his figures for the United States, we shall have to discount them heavily. The editor of *THE HORSELESS AGE* may be presumed to have facilities for keeping a pretty accurate run of the progress of the motor vehicle industry in this country. Of inventors and promoters we have an overplus; our companies far outnumber our vehicles. At the present writing it would be difficult to enumerate more than fifteen manufacturers of motor vehicles in the United States, unless the other forty-five are visible to the Baron's eye only and elude our most searching gaze.

Automobile Club of New York.

The oft-mooted project of forming an automobile club in New York City is at last taking definite shape, and a call has been issued for a meeting to take place at 8 o'clock on Wednesday evening, June 7, at the Waldorf-Astoria Hotel. Several names for the new organization have been suggested, but that which seems to meet with most favor is the New York Automobile Club, or the Automobile Club of New York. Messrs. Whitney Lyon and Geo. F. Chamberlain are the leading spirits of the movement. Mr. Lyon's address is Hotel Beresford, New York. Parties who own motor carriages or have ordered them are eligible to membership.

The Dos-a-Dos.

In spite of Mr. Duryea's plea for the dos-a-dos, the editor's opinion is unshaken. The dos-a-dos is a mere foreign imitation, unsuited to the use of the average American citizen, uncomfortable and unsightly. The majority of middle class buyers will not tolerate them, and the mechanical geniuses of the motor vehicle industry are advised to cudgel their brains and produce something better if they wish to secure this class of trade.

A Safe Storage for Gasoline.

A gentleman who owns a gasoline carriage has had his storage tank buried in the earth, not far from his barn. There is no danger of its being tampered with, and it is almost as easy of access as it would be in the building itself.

WANTED.

Special contributors to *THE HORSELESS AGE* on all important subjects relating to Motor Vehicles. Fair compensation. Address *THE HORSELESS AGE*, 150 Nassau Street, New York.

From Cleveland to New York Against Time.

ALEXANDER WINTON'S BRILLIANT EXPLOIT.

In our last issue we left Alexander Winton, president of the Winton Motor Carriage Co., at Buffalo, N. Y., in his run against time by motor carriage from Cleveland, O., to New York City. As the editor has had an opportunity to interview Mr. Winton and glean from him many interesting facts relating to the journey, it will be pardonable if we return to the starting point and accompany him over the first part of the route again.

The start from the City Hall, Cleveland, O., was made at 6 o'clock on Monday morning, May 22, Mr. Winton having previously insured his life for \$15,000 in view of the dangers attending road racing. The carriage he selected for the trial was of the model of 1897, weighing 1,500 pounds and driven by him thousands of miles within the past two years. Some 200 pounds of extra parts were taken along, and the reporter of a Cleveland daily newspaper which had assisted in the organization of this *tour de force*, sat with Mr. Winton in the seat. The water and gasoline tanks were full.

Notwithstanding that the speed of motor vehicles in Cleveland is limited to eight miles an hour the five miles from the City Hall to Lake View was run in about twelve minutes, and in some places through the Western Reserve thirty miles an hour was made.

The first stop was made at Geneva, O., to inquire the way. Five miles out of Erie, Pa., Jackson Koehler, of Erie, who owns a Winton carriage, met the travelers, and accompanied them into the city, inviting them to take dinner with him. The cyclometer here registered 102 miles from the starting point. About an hour and a half was consumed in Erie, and on leaving the place Mr. Winton was persuaded to take a gallon and a half of gasoline, although he had sufficient with him for the run to Buffalo.

The next stop—half an hour—was at Silver Creek, N. Y. From here on a rain storm was encountered, making the road very muddy, and, together with a strong head wind, interfering with speed and with the comfort of the travelers.

The only accident on this part of the route occurred in the vicinity of Erie, where a bottler's wagon was overtaken, the driver of which was in a drunken stupor, and could not attend to his horses. The wagon was overturned and the driver thrown to the ground, but without serious injury. About fifteen minutes was lost here in turning back to look after the drunken driver, who was left in charge of friendly farmers. Two hours were also lost in the darkness on the outskirts of Buffalo, trying to find a road that would lead to the city, a fact which accounts for the cyclometer registering 218 miles, and the fact that the city was not reached until 8 o'clock. The actual running time was about eleven and one half hours.

At 8 o'clock Tuesday, the journey was resumed over good roads as far as Rochester and Fairport, which was reached at 4:45 P. M., no refreshment having been taken on the way. Here, just as they were entering the village, they were startled by a loud report, following close upon the front wheel striking a stone, and about 100 feet further on the carriage went down the bank on one side of the road, throwing the occupants ahead more than 30 feet, but luckily not injuring them seriously. The carriage was making twenty-five miles an

hour when the accident occurred, and the forward end was so deeply imbedded in the ground that it had to be dug out. The motor was not stopped by the shock and continued to turn the free hind wheel like a top. The front wheel, which broke from the axle, went coasting on for 100 yards or more. Although the front spring was badly bent out of shape the machinery of the vehicle was intact. Mr. Winton telegraphed to Cleveland for another front axle, and put up at Fairport for the night. It was 10 o'clock the next morning before the repairs could be finished and the journey resumed for Syracuse, eighty miles distant. Execrable roads were encountered on the way, consisting of heavy clay cut up into ruts and baked hard in the sun. The accident of the day before also tended to make Mr. Winton more cautious, and it was 6 P. M. before Syracuse was entered. Here the travelers put up for the night, leaving at 4:50 the following morning for Utica. The bad roads that hindered their journey west of Syracuse retarded them east of it also, until they entered the Mohawk valley, where good roads were the rule, the only exceptions being the places where they were making the roads. The distance from Syracuse to Albany is 147 miles, and as they approached the latter city over the grand Eastern Boulevard extending as far out as Schenectady, the carriage was driven at its top speed of thirty-five miles an hour, when the motor makes 900 revolutions a minute, the normal speed being 600 revolutions. Down some of the long hills the machine coasted at forty miles an hour. At Albany the odometer showed 545 9-10 miles. At 5:04 o'clock on Friday the journey of 161½ miles to New York was commenced. From Albany to Hudson, where they stopped for breakfast, bad clay roads were found. Further on the roads improved and good time was made. An hour was consumed, however, in coming down through the city via Broadway and the Bowery to the City Hall, which was reached at about 6 o'clock.

The entire running time was forty-seven hours and thirty-four minutes. The amount of gasoline consumed on the journey was fifteen gallons. The same cooling water that was put in the tank at Cleveland Monday morning was in the tank on the arrival at New York, the loss by radiation and leakage (the tank sprung a leak at Fairport when the axle broke) being about six gallons. To the high speed maintained, causing a free circulation of air around the water tank, is due the extremely small amount of water required for the trip.

The motor ran through without attention, except the oiling the whole machine received once a day and the general inspection to see that everything was tight. Only one bolt dropped out on the way, and that was in the foot brake, and was undoubtedly started by the accident at Fairport.

AGAINST ROAD RACES.

But the most valuable lesson to be learned from this performance is the testimony which Mr. Winton now bears to the impossibility of organizing any road races in the present state of American roads. Until we have better roads we want no road races, he says. But if anybody has courage enough to run a race with him and the authorities permit it and allow the right of way, he is willing. They are cutting down the speed of their machines to twelve to fifteen miles an hour maximum.

The machine proved to be none too heavy for the rough roads, as its weight tended to keep it down to the road, whereas a light machine would have been dashed to pieces, even at a lower speed, and the passengers in such a conveyance would have been so jostled and shaken up that they could not have proceeded far. Mr. Winton and his companion were bruised, and sore from the shocks and vibration of the road as it was,

Much time was lost en route from the necessity of humoring frightened horses. In overtaking horses the machine was pushed at top speed, and passed so quickly that the beasts had no time to be frightened. In other cases it was deemed best to stop the machine and wait until the terrified animals could be coaxed past it. In all a half or three-quarters of an hour was lost in this way, and probably two hours in going out of the way. The odometer register of 707 miles includes the distance traversed when they had gone astray or were in search of the right road, so that it is probable the direct road would not measure more than 600 miles, and from the running time perhaps two hours and thirty-four minutes may be subtracted for the various delays and errors, leaving about forty-five hours actual running time. The average speed therefore was over fifteen miles an hour.

Gibson's Carbonic Acid System.

THE LIGHTEST ENGINE OF THE POWER EVER BUILT.

For nearly three years the editor of THE HORSELESS AGE has been awaiting the completion of a system of vehicle propulsion to which C. D. P. Gibson, a well-known chemist and mechanical engineer, of Jersey City, N. J., has given his undivided attention. The motive agent employed is carbonic acid, a gas of wonderful expansive power, but beset with difficulties in its practical application to vehicles. Thousands of dollars have been spent in futile attempts to control it, its tendency to freeze in the valves being an unsurmountable obstacle to previous inventors in this line. It was with much satisfaction, therefore, that the editor received from Mr. Gibson an invitation to inspect the finished carriage, test its riding qualities and make such notes as might be permitted while foreign patents are pending.

The vehicle, which Mr. Gibson has chosen to first exemplify his system, is a stanhope with the usual tubular truss frame and tangent wire wheels, the front thirty-six inches and the rear thirty-eight inches in diameter. The customary compensating gear regulates the rear wheels, its location being in the same plane as the driving sprocket. Provision is made for an extra seat if desired.

While the general design of the carriage is attractive and all the visible details finished in a thorough mechanical manner, interest centers chiefly in the ingenious mechanism concealed in the body of the vehicle, where is an engine weighing only thirty-two pounds, yet capable of developing twelve H.P., the highest engine for its power so far known.

The carbonic acid is stored in commercial cylinders made by the Cooper Chemical Co., of Newark, N. J., tested by Mr. Gibson to 6,000 lbs. pressure, and each having a capacity of ten to twelve pounds of acid. They are about four feet in length and five inches in diameter. Eight of these are carried in the carriage, four on each side, constituting what Mr. Gibson calls a "battery," the two batteries containing enough acid for a run of eight miles on country roads. The reason for the arrangement in two batteries is to prevent the operator from exceeding the radius of action of the vehicle. When one battery is exhausted it is a sign to return to one's destination, and inasmuch as the second battery contains the same amount of acid as the first, a safe return is assured. This present method of storage, however, is merely the best available at present, and when vehicles are manufactured in quantities it will superseded by an improved method which Mr. Gibson says will allow a run of 30 miles on one charge.

The acid is conducted through the ordinary commercial valve and a small pipe to the very heart of this system, the Gibson valve, in the engines and the cycle, controlling the flow of the acid under all circumstances, which prevents freezing and is easily manipulated. Particulars of this most remarkable achievement Mr. Gibson is not prepared to give for the reason above stated, patents having been applied for in a foreign countries.

In the rear of the body are two valves, each controlling a battery one only being opened at a time. To make due allowance for expansion the cylinders are filled only half full of gas, the rest of the space being left for the air cushion, which serves the same purpose as a dome in a steam boiler.

The ordinary working pressure of the acid is between 2,500 and 2,700 lbs., maintained by a gasolene burner under the expander, the flame of which is closely regulated by a diaphragm. If the acid should reach a temperature giving 3,000 lbs. pressure the diaphragm automatically moderates the flame and immediately brings the pressure down to the normal. Any higher pressure than 3,000 lbs., could not be practically employed, because the wear and tear on the apparatus would destroy the economy. A gallon of gasolene will supply this burner for a week. The engine which handles this mighty force is surprisingly small and delicate in appearance, although it is in reality as strong and durable as science can make it of such weight and for such duty. It is of the horizontal, reciprocating type and has two cylinders, $1\frac{1}{8}$ inches in diameter with four inch stroke. When the carriage runs a mile a minute the engine is making 1,876 revolutions a minute. A noticeable feature is the absence of noise, the little 5-16 pistons and the valves performing their functions almost as silently as clockwork. At 500 revolutions and 500 lbs. pressure the engine develops twelve H.P., which is sufficient to handle a heavy truck on city streets. All parts are made of hardened, ground and tempered steel, and are encased from dust. Power is transmitted direct to the rear axle from a nine tooth sprocket of $1\frac{1}{4}$ inch pitch on the engine shaft to a thirty-nine tooth sprocket on the rear axle.



GIBSON'S CARBONIC ACID CARRIAGE.

One lever performs all the operations of controlling the vehicle with the exception of the band brake on the rear axle, which is brought into play by a pedal, but is seldom used because the engines when shut off automatically brake the carriage. In the manipulation of this lever a right and left motion steers, a rocking motion controls the power, and by raising the handle the engine is reversed and energized by the same rocking motion.

There are no gauges to watch and burden the operator with anxiety. The controlling mechanism is kept free from vibration by means of compensating devices in the frame and in the controlling mechanism itself, so that whatever the relative positions of the wheels the lever is always safe in the hand.

A unique feature of this system is the immense reserve power that is available for sand, for hills and emergencies of any kind. In the course of the ride which the editor took with the inventor, deep sand was traversed with ease, and as conclusive evidence of the power of the engine the vehicle was very slowly run into the barn over an abrupt rise of six inches with the passengers in it and without any momentum such as is generally required to surmount such an obstacle. Carbonic acid is apparently an ideal power for city use, being particularly recommended for the propulsion of trucks and other work wagons. The motive agent has hitherto been so costly to produce as to make its economical use for power purposes out of the question, but it is now stated that the cost of production has been lowered to \$3 a ton, rendering it available for this purpose, and a strong syndicate is being organized in New York to develop the Gibson system for road vehicles and street cars.

The total weight of the Gibson carbonic acid carriage is 850 pounds, cylinders included.

The Owen Gasolene Carriage and Delivery Wsgon.

The accompanying photo shows the motor carriage of the R. M. Owen Carpet Cleaning Co., of Cleveland, O., which can also be used as a delivery wagon, the lettering being arranged so that it can be removed and replaced by an extra seat in a few minutes. The vehicle is propelled by an eight horse power gasolene motor, giving the carriage a speed of from two to fourteen miles an hour. The wagon and motor was designed and built by R. R. & R. M. Owen.

In speaking of the practicability of the gasolene motor wagon for delivery purposes, R. M. Owen, manager of the company, says: "We have been using this wagon in our business since January 1 and find it thoroughly practical in all kinds of weather and on all roads we travel over in our business. We cannot recall a single instance when we sent a load of goods out for delivery that impassable roads were encountered, and it is specially useful at this season of the year when our business is scattered over so much territory that it often requires a trip of from six to thirty miles from the time we leave the factory until we return."

They carry from 800 to 1,000 pounds of carpet and also an extra person with the driver at a speed of from eight to twelve miles per hour.



OWEN GASOLENE CARRIAGE AND DELIVERY WAGON, CLEVELAND, O.

LONDON NOTES.

TURCINELLI AND PEZZA'S ELECTRIC CARRIAGE.

LONDON, May 18, 1899.

Further particulars are available this week regarding the new electric vehicle which has lately been imported into Milan, Italy, by Turcinelli & Pezza, to whose designs it was constructed. I was in error last week in stating that the two motors were connected to the rear wheels. On the contrary, they are attached to the front wheels, in the same way as in the Krieger cabs. The motors are of the four pole type and are capable of developing up to four H.P. each; they are connected to the front wheels in the ratio of 1 to 16.5. The accumulator employed is that known as the Faure; forty-four cells are employed, arranged in two batteries of twenty-two cells each, one being located under the driver's seat and one under the rear seat. The weight of the batteries is stated to be about 996 pounds, and their capacity is sufficient for a continuous run of sixty-two and a half miles, a statement which electrical motor vehicle engineers, in the absence of tests, will be inclined to doubt. The accumulators are arranged to be grouped either in series or in parallel and the controller is adapted to take eight positions, speeds of four, eight, twelve, sixteen, twenty-five and thirty kilometres an hour being available. The weight of the vehicle complete is given as 2,640 pounds.

MOTOR POSTAL WAGONS.

The Daimler motor vans used by the British postal authorities, referred to in this column in the issue of the 3rd of May, have been temporarily withdrawn from service owing to trouble with the circulating pumps. As soon as the necessary alterations have been completed the vehicles are to be again put to work. A further extension of the use of motor vans by the postal authorities is announced from Edinburgh, Scotland, where the local post office people have arranged with a concern known as the Madelvic Motor Carriage Co., Ltd., of Granton, N. B., for the transport of the mails between Edinburgh and Leith. For some reason or other the Madelvic Co. are very reticent as to the details of their vehicles, which are of novel design and propelled by electricity. The accumulators, motor and transmission gear are all mounted on the axle of the front wheels, forming what is termed in France an *avant train*, which can be applied to any horse vehicle by substituting the *avant train* for the ordinary front wheels. No details as to the type and capacity of accumulator or of the motor are available.

THE LONDON ELECTRIC CABS.

Owing to some trouble with the new band brakes, the electric cabs have not yet made their reappearance on the streets of the metropolis. It is, however, now stated that this will be done on Wednesday next, the 24th inst., the Queen's birthday, by a parade of no less than eighty vehicles through the streets of the city and West End. In the interval, the old vehicles have been completely overhauled and a large number of new ones finished, and with new arrangements with the drivers, who have given considerable trouble in the past, the company may now be expected to have largely mastered the difficulties which present themselves to every new concern. Of the eighty cabs now available, most will be put in service as ordinary cabs plying for hire, but a few are to be retained for private hire, either by the hour, day, week or month. A scale of charges has just been issued which shows that for the

first two hours the charge is \$1.80, and for each additional hour 84 cents. For a day of nine hours the charge is \$6, and for a week of six days, \$33 60.

THE DUCROISSET GASOLINE CARRIAGE.

I have had an opportunity this week of inspecting the new Ducroiset carriage which has just been imported into England by the Automobile Association, Ltd., of London, W. The vehicle, which is built by J. Ducroiset & Sons, of Grenoble, France, takes the form of a large wagonette. It is propelled by a horizontal gasoline motor of eight H.P., located in the front of the vehicle. The motor has two twin cylinders, and is provided with a water jacket, while the ignition is electric. Three mechanical forward speeds, $6\frac{1}{4}$, $11\frac{1}{4}$ and $17\frac{1}{2}$ miles an hour, as also one reverse speed, are provided, further variations in the speed being obtainable by advancing or retarding the ignition. A feature of the transmission gear is that a separate belt, working on its own pair of pulleys, is provided for each of the three forward speeds and the reverse. The belts all normally run slack. Between each is arranged a small jockey pulley, which can be raised or depressed as desired. Thus any speed can be obtained by pulling over the corresponding lever, and depressing the particular jockey pulley and tightening the belt. From the countershaft the power is transmitted to the rear axle through the usual sprockets and chains. Three brakes are provided, one each acting on the bosses of the rear wheels and one band brake, acting on the differential countershaft. The latter is so arranged that when put into action the tension on the driving belt, no matter which of the three, is simultaneously released, so throwing the motor out of gear with the transmission mechanism. The Ducroiset vehicles are built on a standard frame so that any type of body may be fitted, the particular wagonette under notice being readily convertible into a delivery van. The vehicle was brought to England by the builder himself, the vehicle being driven by road from Grenoble to Dieppe, France, a distance of 475 miles, in a net running time of just about thirty hours, or at an average speed of $15\frac{1}{2}$ miles an hour.

GEAR CASES.

Although the gear case has met with very little adoption in America on bicycles, it is anticipated that builders of motor vehicles will find it imperative to employ such contrivances. At any rate, this has been the experience of constructors in England, who are now nearly all providing their driving chains with cases to protect them from the dust and mud, which by reason of their low position, they are liable to pick up. One or two firms here are now devoting attention to the production of chains and gear cases for motor vehicles, among them the Presto Gear Case & Components Co., Ltd., of Fleet street, Coventry, which is also making a special feature of water and gasoline tanks for gasoline vehicles.

ACACIA WOOD SPOKES.

One of the topics of the hour in motor vehicle circles on this side of the Atlantic is undoubtedly that of drive wheels. Ever since the tragic death of Sewell, the Daimler Co.'s expert driver, owing to the collapse of the rear wheels on one of their vehicles, the matter has been discussed. In this connection it is interesting to note that Panhard & Levassor, the well-known Parisian builders, employ road wheels, the spokes of which are made of acacia wood. The wheels are said to have given every satisfaction and English builders are being urged to try them.

ALUMINUM PARTS.

A good deal of attention is just now being devoted by English constructors of motor vehicles to the reduction of weight by the employment of aluminum or aluminum alloys in many of the parts of the motor and transmission gear. The Eclipse Brass & Copper Co., Ltd., of Halifax, which is making a specialty of castings in a special aluminum alloy, has recently secured a large order for such castings required for thirty large steam omnibuses, and another large contract for crank-chambers, mufflers, etc., for a large number of gasoline motors.

In consequence of the increasing demand for capable motor-men, the Motor Manufacturing Co., of Coventry, are offering to find permanent situations for any young men who are willing to give some little time to be perfected in handling motor vehicles.

Among the latest additions to the membership of the French Automobile Club is Albert Geiger, vice-president of the American Automobile & Motor Co., Devonshire street, Boston, Mass.

Particulars have just been received here of the formation of a new company in Brussels, Belgium, with a capital stock of \$80,000, and with the title, La Société des Automobiles et Moteurs.

Some strange rumors are current as to the future of the Daimler Motor Co., Ltd., of London and Coventry, rumors which have been intensified this week by the announcement of the resignation of E. C. M. Instone, the secretary, and A. H. D. Altree, the general manager. It is also understood that Mr. Sturmex, of the *Aulocar*, has resigned his directorship.

Graham Equipment Co. Enlarges.

The Graham Equipment Co., of Boston, Mass., manufacturers of Graham's spring suspension and equalized braking device, are preparing for an active campaign in the field of the heavy motor vehicle. They report that they have orders for \$60,000 worth of trucks on hand now, and orders to an equal amount promised. They are moving from Cambridgeport, where they have been located for the past six years, to larger quarters in East Boston, and are preparing plans for a new building 310 feet by 80 feet and six stories high, which will be equipped with the latest machinery.

The Graham spring suspension, which is claimed to be the only device aside from the rubber tire that will enable a vehicle to run over rough roads without excessive vibration, consists of a combination of coil and leaf springs, the latter

being placed above and supplementary to the coil springs, one of which is put over each wheel. The coil springs, therefore, take the load when it is light and the leaf springs when it is heavy, so that under all conditions of load a free spring suspension is obtained.

The company has also decided to offer to the motor vehicle trade a line of supplies, including swivels, axles, ball bearings, steel rims, metal hubs, steering apparatus, independent tubular carriage frames, steam, gasoline and electric motors, all types of boilers, tanks and steel work of every description.

COMMUNICATIONS.

"Higher Power."

NEW YORK, May 26, 1899.

Editor of HORSELESS AGE:

I am much pleased to see in your current issue Mr. Duryea's letter on "Higher Power." Mr. Duryea has got to that stage of the game where he is able to tell us something of importance, instead of using your columns to brag in.

None of us wants to put a slow speed upon our carriages, of less than four miles an hour. I believe we should have power enough to lift our total weight at that speed. For example, take the figures given by Mr. Duryea: 6 H. P. = 198,000 ft. lbs. $198,000 \div 700 \text{ lbs. total weight} = 283 \text{ ft. per minute}$. $5,280 \div 283 = 18 \text{ minutes to the mile}$.

Mr. Duryea has thus almost reached my standard. Many of my friends think this standard is too high. It must be remembered, however, that we must not only climb hills and go through mud, but must climb hills and at the same time go through mud.

Yours truly,

VIATOR.

Rear Axle Construction.

NEW YORK, May 23, 1899.

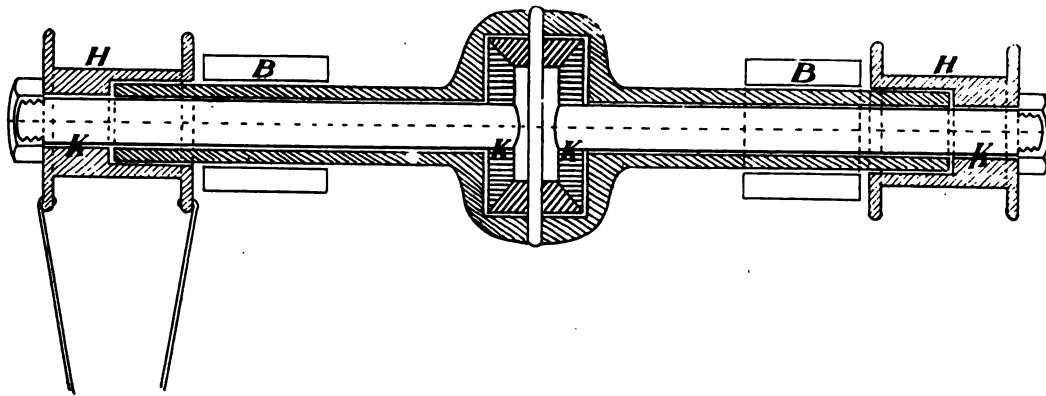
Editor HORSELESS AGE:

I enclose a drawing of a method of forming the compound shaft with compensating gear, now in actual use. In this form one gets the benefit of the rigidity of all the metal used, whereas in the ordinary forms much is of no use and the resulting mechanism must be weak or heavy or both.

The drawing explains itself. K are key ways, H is the hubs and B the bearings (rollers with thrust ball collars at the outer ends). The novel point is that the sleeve runs through the bearings and half through the hubs, thus adding its stiffness to the structure at the most important point.

Yours truly,

VIATOR.



Artillery Wheels for Motor Vehicles.

BY R. I. CLEGG.

IN THE HORSELESS AGE for May 10 a firm of carriage builders, J. M. Quinby & Co., transmit an inquiry from a manufacturer of motor vehicles in London, relative to the practicability of artillery wheels in this line of business. Although the editor called especial attention to the letter and the questions involved, so far I have not had the pleasure of reading any additional comments on the matter.

The discussion would have been aided materially if the London firm, who originally propounded the inquiry, had furnished some data relative to the particular make of wheel they had under consideration. As luck would have it the writer had some experience with English field pieces over a dozen years ago, but this knowledge is, at this date, rather passé, though one of the methods then in vogue in the construction of artillery wheels is doubtless still in use. At that time the custom was to assemble the wheels under hydraulic pressure—the component parts being supported in a suitable frame or “jig,” and the several plungers of a special press then being brought into simultaneous operation, forced the pieces together into a compact union at a single movement.

It will be understood, of course, that the several tenons were made to a special degree of accuracy uncommon in the manufacture of wooden wheels at that time, and that the mortises were equally a matter of careful workmanship, in order that tenon and mortise should come together at a pressure that would guarantee permanency under the trying conditions of hilly warfare and tropical climes; that is, the stress must not reach the stage where destructive strains are set up nor shall it fail to pass the point where the retentive force is but barely sufficient for ordinary usage.

It would not be at all surprising if the majority of the artillery wheels, now being put into service in Great Britain and her dependencies, were constructed closely upon the lines followed in this country. The American inventor, as well as the ingenious contractor, who has followed in his wake, have set a high standard abroad in both quality and quantity in manufacturing. Formerly a greater proportion of gun and projectile work was done in government shops than I understand is now the case, when private enterprise is more vigorous than ever. It may be here remarked that the machine for assembling wheels under hydraulic pressure was noted at the government shops at Woolwich, England. Some time ago I noted, with considerable interest, the extensive plant of the American Ordnance Co., at Bridgeport, Conn. There, if anywhere, they must know all about artillery wheels and their suitability for motor vehicles, and I sent an inquiry forthwith. The Ordnance Co., however, referred me to a wheel manufacturing corporation of Lawrence, Mass., who furnish all the wheels used by the United States government on modern artillery, and this includes a large range of sizes from four-inch axles for five-inch siege guns, down to the lighter ones in use on Gatling, Hotchkiss and other machine guns. All their wheels have metallic hubs only, but are made plain or roller bearing, according to the requirements of the purchaser. I have under course of preparation some sheets of roller bearings of different makes that I shall send later and will then consider that detail. At present this company are making a number of sets of wheels for motor vehicle builders made on practically the standard hub sizes with an added back

flange on which to bolt the gear. The steam motor fire engine, in Boston, was equipped with this make of wheel.

These wheels are made from two feet up to seven in diameter and for axles one and a half to five inches; the wheels are assembled in a power driven screw press capable of bringing a pressure of 100 tons upon every joint of the wheel. A wheel of this construction made from New England oak and hickory butts will stand hard use and abuse to a remarkable degree and, so far as wooden wheels are at all desirable for motor vehicle service, the artillery wheel contains the results of a lengthened experience under the most drastic conditions and is therefore well worth the attention of the motor vehicle designer.

The fact that manufacturers of motor vehicles, who had extended practice in the construction of bicycle and metal wheels generally, have taken up this style of wheel would of itself be convincing as to the merits of the artillery wheel for motor vehicle purposes.

The designer will find considerable material bearing on the retentiveness of various woods, in Haswell's “Pocket Book,” deduced from the experiments of Johnson and Bevan. The same work contains a table of constants given by D. K. Clark, from which the deflection of wooden beams as well as other similar calculations may be made. The “Hand Book” of the Carnegie Steel Co. and the “Treatise on Aluminum,” of the Pittsburgh Reduction Co., contain data relative to the strength of various woods.

The strength of a joint made by pressure, as in artillery wheels, appears to attain its greatest effect when the force bringing the parts in position just fails to turn the fibres of each surface in contact into the same direction; i. e., the fibres of the one should be at right angles to the other surface. For example, it has been ascertained that a round blunt bolt, driven into a hole of a less diameter, has a retention equal to that of any other form wholly driven into wood without boring.

Contract Signed at Buffalo.

The National Motor Transit Co., of Buffalo, N. Y., the company organized to operate motor vehicles in the parks of that city, has signed a contract with the Park Commission agreeing to put four carriages in service by August 1. The contract runs for one year from April 1, and specifies that the motive power employed must be either gasoline or electricity. Gasoline will be employed, it is stated, in these first carriages. A five cent fare is stipulated for a full trip or part thereof. The vehicles must be run at least every 30 minutes until November 1, must conform to the park ordinances, must have the drivers or conductors in uniform and must let passengers on or off at any point they desire. If the carriages frighten horses, they must stop until the frightened animals are quieted and pass on. The company assumes all liability for accidents or suits arising therefrom; and has given a bond for \$50,000 to indemnify the city against any loss through such suits. The carriages must be as noiseless and odorless as practicable, they must not run at a greater rate of speed than eight miles an hour and their design must be approved by the Park Board. The board reserves the right to terminate the license at any time, after giving the company due notice and a hearing. The motors and machinery are now being built in St. Louis, while the wood work is being done in Buffalo.

About one-half of the route of the motor carriages lies within that part of the park included in the Pan-American site.

Single or Double Electric Motor Equipment.

C. E. F. AHLM.

When considering electricity as a motive power for vehicles, one of the first questions which confronts the designer is whether to use single or double motor equipment. The opinion at present seems to be more in favor of the latter, though the single motor also has its advocates.

If, as in street railway practice, the power could be applied to both axles of the vehicle, the points in favor of the two motors would probably be greater, but as we in motor-vehicle work usually have but one driver, (the other axle supporting the steering wheels) these points might be questionable.

Considering a vehicle as usually built, and remembering that, whether single or double motor equipment be used, the speed of the vehicle as well as the weight will be the same under the same conditions, the following should guide us when making our choice between one or two motors:

- 1st. Maximum power for minimum weight.
- 2nd. Compactness, accessibility, and least possible number of parts.
- 3d. Prime cost and cost of maintenance.
- 4th. Simplicity and flexibility of control.

1ST. MAXIMUM POWER FOR MINIMUM WEIGHT.

In motor-vehicle practice, more so even than in street railway work, the relation between weight and output is one of the most important factors, and in both cases we require a motor with the greatest possible starting torque. Suppose the power required at the motors is 3 H.P. for our special case. As we wish to keep the speed of the vehicle constant and also maintain the same gear ratio, the speed of our motors will be the same—assume 1,000 R.P.M. for a single 3 H.P., or a double 1½ H.P. equipment. If both sizes of motors are designed with the same care both mechanically and electrically, and the weight of the 3 H.P. motor is 390 lbs., the 1½ H.P. will weigh about 275 lbs., which allowing 50 lbs. for the differential gear, still leaves 110 lbs. in favor of the single motor. The output in either case is equal both as to normal and overload, but there will be a gain of from three to four per cent. in efficiency in favor of the larger motor.

Accordingly, both as to weight-efficiency and commercial efficiency, the single motor equipment is preferable.

This gain in commercial efficiency will be quite noticeable and will result in an increase of mileage above the two motor vehicle.

As to the gain in weight, it might be used either to increase the load capacity of the vehicle or, if utilized in the motor itself, to increase its starting torque. The equation of torque for a series motor might be written $T = KNCa$, where K is a constant in any given case, N represents the magnetism, and C a the armature current. The factor representing the iron losses, which are proportional to the amount of armature iron, the armature speed and the magnetism, has been neglected, as it will be of little or no account when only considering the torque at starting. From the above equation, we find that the torque increases with the armature current and the magnetism, also that, when starting the motor from rest the speed then being zero, the counter electromotive force is zero, the armature current will be very large and accordingly the torque large. But as in a series motor, the armature current is also the field current which produces the magnetism, our

factor N in the equation for torque will also increase, increasing the torque, but not in proportion to this current except when working the iron of the motor on or near the bend of the saturation curve. This means, however, a lower saturation and accordingly more iron; that is, the motor will be heavier, but the gain will be comparatively great for a small sacrifice in weight.

If we use to this effect the gain in weight which we realized in the single motor equipment over the double, we would for the same weight increase the starting torque of the former several per cent.

The new single motor would be designed with a medium saturation in its field iron, but otherwise with the same densities as the old one, so as to make no change in other respects.

2ND. COMPACTNESS, ACCESSIBILITY, AND LEAST POSSIBLE NUMBER OF PARTS.

The wheel gauge used in motor-vehicle work is the same as in ordinary carriage practice, viz.: 4 ft. 8½ in.; accordingly there is sufficient room horizontally, and two motors might be applied to the same axle with as much ease as one, and without sacrifice as to accessibility of the different parts. Vertically, on the other hand, the smaller motor will take considerably less room than the larger one, and in this respect the double motor equipment will have some advantage, as there is usually very little room under the vehicle body.

In regard to the number of parts, however, the single motor equipment is preferable, having only half as many parts as the double equipment, and accordingly also half as much liability in getting out of order and causing trouble. This is quite important when considering that the moto-vehicle is handled mostly by persons who know very little if anything, about the construction of the motors.

3D. PRIME COST AND COST OF MAINTENANCE.

If the manufacturing cost of our 1½ H.P. motor is \$55, the cost of the 3 H.P. motor would be about \$70. With the double motor equipment goes two gears and two brakes, but the single motor requires a differential gear which, as to cost, probably will exceed the former. Suppose we assume the difference would be as much as \$10, then we have still \$30 in favor of the single equipment. As to cost of maintenance, it will increase in proportion to the number of parts, and accordingly be greater for the double motor equipment.

4TH. SIMPLICITY AND FLEXIBILITY OF CONTROL.

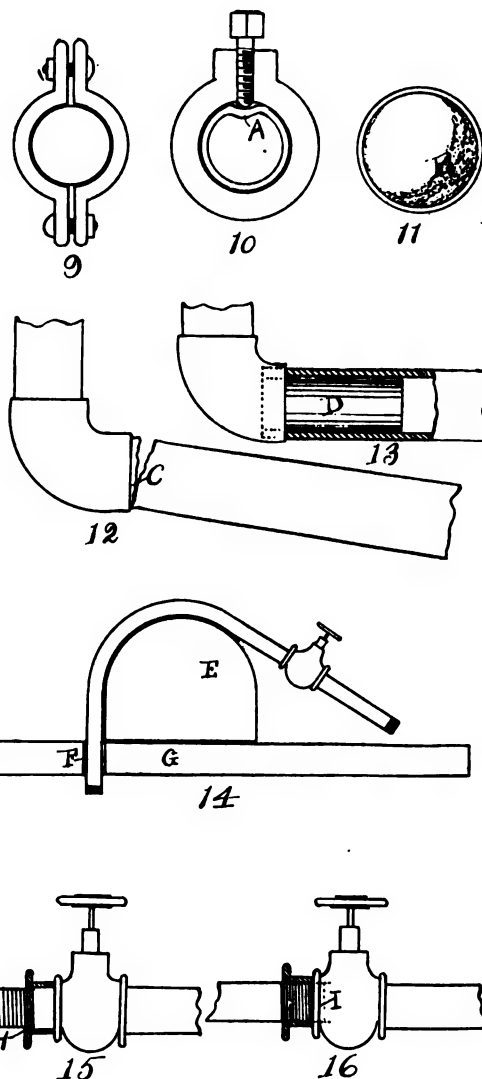
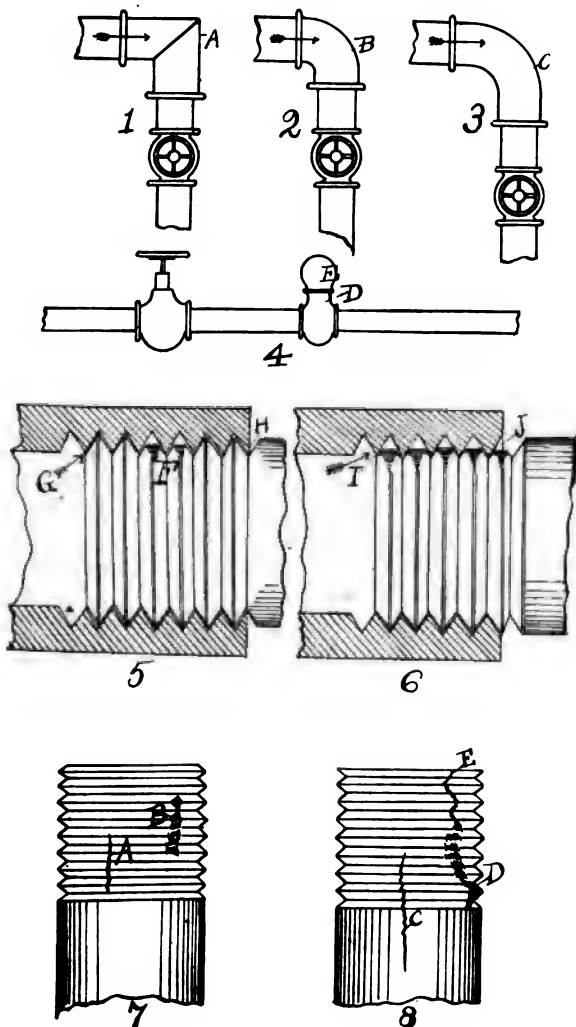
The control of a motor-vehicle equipment is usually accomplished by a special switch which arranges batteries and motors in different combinations. Accordingly, the double motor equipment would make possible a wider range of speeds and afford more flexibility with less complicated controlling arrangement than the single equipment. But within the limits required in ordinary motor-vehicle practice, the flexibility of control, as limited by the cessation of simplicity, is quite enough, and in this respect neither has any material advantage over the other.

Summing up the foregoing, it would seem as if at the present stage of motor-vehicle practice, the choice should fall to the single motor equipment, but as the art advances, the advantages now in its favor may be nullified. We are as yet, so to say, in the very beginning of a new industry and with the skill and enterprise of the nineteenth century we should expect improvements which might altogether change our present practice.

Motor Vehicle Engineering.

PIPING VEHICLE MOTORS.

The imperfect operation of gasoline and steam vehicle motors is often due to defective piping. Engineers are usually careful to specify the kind of piping to be used, joints, couplings, etc., and are particular as to the method of securing the same to the structural parts of the motors and supply tanks. Builders of motors usually follow these specifications to the letter, and the bulk of the work is about as perfect as it is possible to get it. At the same time, errors creep into the plans, some improper materials are used, a careless workman makes a poor connection, or the piping may be ruined after the motor is in the hands of the purchaser, and the result is an accident of some sort unless the defect is rectified in season. There is a necessity for skilled inspection of piping systems of motors for defective installation plans, worn parts, joints in which leakage is possible through grooved, cut, flat or broken threads, cracked or partly cracked pipes, buckled pipes, clogged joints, lack of air chambers, resulting in noises in the pipes, weak unions, etc. Often the piping system of a motor is rendered unsafe through the careless manner in which repairmen make connections. Again, the owner of the vehicle may attempt to fix something of which he knows nothing and the chances



are that he will press the pipe tongs into a pipe wall and so weaken the pipe that it becomes dangerous. Lack of proper attention also causes trouble in the way of leaky valves, groaning stuffing boxes, squeaks, etc. Sometimes in replacing a defective pipe a pipe of smaller diameter is submitted, and this causes endless trouble. In repairing piping systems of gasoline motor vehicles the properly proportioned pipe elbows are sometimes replaced with square ones, simply because no round patterns are on hand. If the original plans of the piping systems of gas or oil vehicle motors are studied, it will be noticed that the drawings call for the use of round elbows and that sharp angles be avoided. It is well known to engineers that the square elbow is more difficult to effect a passage of either gaseous vapors or oil liquors, not only on account of the increased frictional surface presented, but owing to the difficulty in making the turn. The square elbow is shown in Fig. 1. The contents of the pipe, in turning the angle, must first strike the pipe metal at a. This not only wears the metal, and in time makes the wall so thin that leakage occurs, but it hinders the movement of the flow in the pipe. A better plan is to use the round elbow like that in Fig. 2, in which it may be seen that the movement of the contents of the pipe can be effected more readily. Instead of abruptly contacting with a

flat wall, as at a, Fig. 1, the contents of the pipe strike the curved wall b, Fig. 2, and are gradually carried to the new angle. The long curve is used by some machinists, shown in Fig. 3, in which the idea is to offer the pipe contents a larger turning surface, as at c.

AN AIR CUSHION.

Knocking sounds frequently occur in the piping systems of lines from the supply tank to the motor, due to the lack of an air chamber. Water hammer in steam piping systems is prevented by the use of an air chamber or box joined into the pipe line at a place where the hammering sounds can best be relieved by means of an air cushion. The same idea is applicable in pipes carrying gas or oil, steam or compressed air from the source of supply to the consuming point. Fig. 4 shows the process of inserting the air cavity or reservoir e by cutting the pipe at d and threading the flanges in as shown. The dome e forms an air retort against which the pressure of the pipe contents are received and the knocking sound eliminated.

LEAKS IN JOINTS.

An important part of the successful installation of piping plans for conveying vehicle motor fluids is correct threading of the joints. Suppose that a thread plan of a certain pipe is flattened as at f, Fig. 5. The pressure of the contents of the pipe will force the gases or oils against the first thread at g. This thread is perfect and so is the next, and if the proper red leads or cements are used, these perfect threads will prevent the contents of the pipe leaking at this point. The only way for a leak to occur would be for the vapors or liquids to work their way around all the threads and out at h, but this would not happen. Consequently a pipe thread which contains one or more good threads remaining to hold the joint tight. If however, all of the threads are flattened, as in Fig. 6, the pressure from inside the pipe will force the oils or gases from i to j and produce a bad leak. The only thing to do with a pipe in which all of the threads are flattened is to cut off the threads and make a new end.

BROKEN THREADS.

If a pipe end has some of its threads broken off or is grooved as at b, Fig. 7, the pipe need not be cast away, because there are enough good threads remaining to hold the joint tight. If the pipe is split as at 7, no harm is done, as the cavity is filled with lead when the joint is made. But if the grooving extends the entire length of the threads, from d to e, Fig. 8, the pipe is fit only for the junk pile, unless it is long enough to allow the defective portion to be cut off and a new set of threads cut on. If the split in the pipe extends beyond the body work, as represented by c, the pipe is of course useless and should not be used.

In the event of a pipe thus cracked being temporarily kept in service, the clamping scheme may be used. This consists in employing two forged halves which are clamped and bolted over the broken place in the pipe as illustrated in Fig. 9. Some rubber or leather packing and red lead should be placed between the pipe and the interior of the clamp and the bolts tightened hard enough to close the clamp upon the pipe and bring the fractured portions together, thus stopping the leak.

CARELESS ADJUSTMENTS.

There are several places in motor piping systems where adjustments are necessarily made to the pipes by means of collars and set screws. In adjusting these collars, care should be taken not to exert too much pressure by turning the screw too deep, thus depressing the wall of the pipe, as at a, Fig. 10.

A good way to restore tubes thus indented is to bore a small hole in the middle of the depression, insert a bent wire, and pull the wall of the pipe up into place by twisting the wire around a rod. The wire hole must then be plugged.

CLOGGED PIPES.

The settlings from liquids and scaly substances from several sources are sometimes located in pipes. Fig. 2 shows the condition in which the writer found a pipe that was used to feed oil to a steam cylinder on a steam wagon. The oil failed to mix with the steam and vaporize, and the valves and other parts were hot from frictional heat. The oil pipe was practically closed with scale and other foreign matter as at b. As soon as this was blown out and the pipe cleaned, the oil mixed with the steam in the cylinder and was carried with it to every part of the mechanism. This shows how necessary it is to occasionally inspect the piping systems for clogged places.

BROKEN JOINTS.

If a joint breaks off as at c, Fig. 12, the best remedy is to insert a new piece. But if a new piece of pipe cannot be obtained, the old one may be used again without shortening it, by using a plug d as in Fig. 13. This shows the mended part in section. The plug is simply a piece of the piping of smaller diameter and is brazed to place. If the work is neatly done, the patched place will not show and a firm, tight union will result.

BENDING PIPES.

If necessary to bend brass, copper, seamless steel or wrought iron piping, the form in Fig. 14 may be used. This form is merely a rounded wood block e, which is secured to the wood rosin should be melted in an iron pot and poured into the which one end of the pipe is inserted while the other end is bent down and over the form by hand pressure. To keep the pipe from buckling or collapsing, rosin filling is used. The rosin should be melted in an iron pot and poured into the pipe. This will keep the walls of the pipe up and in original place during the bending process. Besides rosin, clay is used for heavy work, and putty or wax for small, thin pipes.

IMPERFECT FIT.

In overhauling the connection of a leaking pipe in a petroleum motor recently, the pipe was found to be turned into the flange of a valve only three threads, as at h, Fig. 15. The mechanical vibration of the joint so frailly made worked out the little lead it held and of course leakage followed. This defect was quickly fixed by turning the pipe deeper into the union until about two-thirds of the threads were inside. The other extreme of pipe joining is shown in Fig. 16, in which the pipe is turned so far into the union that the mechanism of the seats of the valve is interfered with at I. The remedy consists in making correct measurements of the unions and in putting the threaded sections in to the proper depth.

Stripped threads should be recut and burred places rectified before the machine is sent from the shop.

HORSELESS VEHICLE ENGINEER.

Alexander Winton, of the Winton Motor Carriage Co., Cleveland, O., has entered a protest against the proposed ordinance limiting the speed of motor vehicles to ten miles an hour. He thinks the motor should be allowed the same speed as the street car—twelve miles an hour.

OUR FOREIGN EXCHANGES.

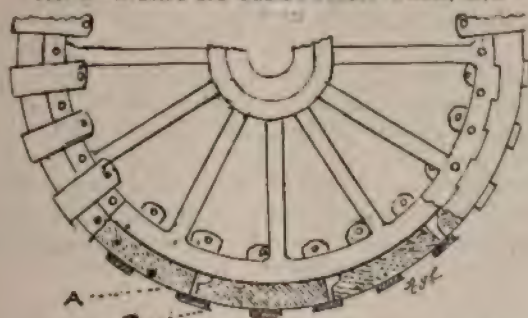
Motor Vehicle Wheels.

Says a correspondent of the *Automotor*:

I have read with much interest the remarks of Mr. New on the unfortunate accident at Harrow, and your criticism thereon. May I be permitted as a student for many years of the problem of road wheels for self-propelled carriages to make a few remarks on the subject?

It appears to me that in the first place it is radically wrong to allow the strain of driving a heavy car to be taken by wood spokes. This is what Mr. Fletcher states in a series of articles on steam carriages recently appearing in *The Engineer*, and although what is stated in *The Automotor* is correct, viz., that many carriages so built are running, yet it is also true that (as further stated) these wheels have run with an exceedingly

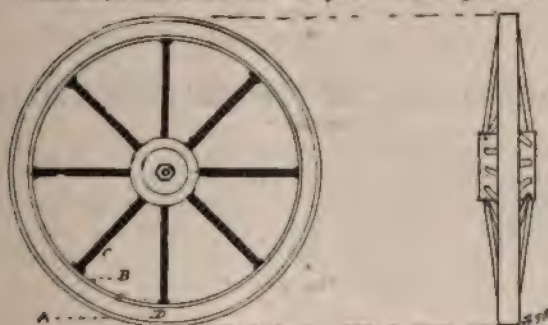
FIG. 1.—Aveling and Greig's Patent Wheel, 1870.



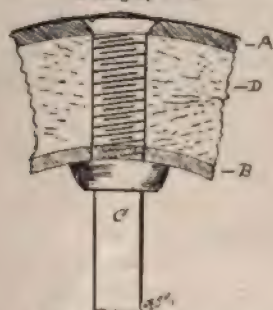
Explanation:—A, rubber segments; B, steel straps; C, guides (from Fletcher's "Steam on Common Roads").

FIG. 2.

Sketch of Wheels used on Mr. Catley's Steam Carriage, 1869.



Enlarged Section of Outer and Inner Tyres, showing Method of Fixing Spokes.



Explanation:—A, outer wrought-iron tyre; B, inner wrought-iron tyre; C, spoke; D, wood felloes between inner and outer rims.

narrow factor of safety. With a reasonably light car (say) not exceeding one ton total weight, and where the wheels are small, for example, not over three feet, there may be certain advantages in wood wheels, but even there, from my personal observation, the spokes should be stout and not too numerous if wood hubs are used. Metal hubs are all well enough, but some sort of attachment, like the "Lifu" Company's method, to the felloe is absolutely essential, and I think the pernicious practice of bolting the sprocket wheels onto the spokes cannot be too strongly condemned. This, I venture to remark, is one of those matters which they do not "manage better in France," and illustrates the heedless way some of our manufacturers have followed French design without endeavoring to improve thereon. In a steam brougham built in 1874 by Mr. H. Mackenzie, of Scole, near Diss, Norfolk (I am quoting from Mr. Fletcher's "Steam on Common Roads"), the chain-wheels were bolted on the spokes by ring clasps, which avoided the weakening of the spoke by piercing it for bolts, which, notwithstanding the spokes are thickened at the spot, is a distinct element of weakness. In a wooden wheel surely a better plan (if a metal hub is used), would be to turn a seat for the sprocket wheel which could be secured by keys or other suitable attachments. If ring clasps round the spokes were used as a supplementary attachment, no doubt a good job would result.

Now, as to heavy wheels—still quoting from the same source—I find that in 1870 Messrs. Aveling and Greig patented the form of wheel of which I enclose a sketch (see Fig. 1), and which seems to me to be what is really wanted, the rubber being relieved from all driving strain (as pointed out by your correspondent "W. S."). By reference to the sketch it will be seen the wheel is built up in the usual manner adopted by traction-engine builders. The rubber is applied to the rim in segments, and over each joint is a steel crossbar which slides between the guides on the face of the rim; the rubber is thus protected, and the steel bars take the driving strain. I should say the rubber is fixed by Messrs. Sterne's process. In those cases where, from motives of economy or other reasons, it is undesirable to use rubber at all, I beg to submit the plan adopted on a very neat little steam carriage built by Mr. Catley in 1869 (see Fig. 2). The method of construction (quoting from *The Engineer*) was as follows: The hubs of the wheels were of cast iron, the spokes of wrought iron (set as a bicycle wheel), and there was an inner and outer rim of wrought iron, wood felloes being disposed between the rims. The spokes being cut to length were forged at the rim end with a shoulder, and were likewise threaded, being screwed through the inner rim, the wood felloe and the outer rim, where they were riveted, making a strong, substantial fixing; the wheels were then sent to the foundry, where the hub was cast round the inner ends of the spokes. Now, although many will take exception to this last, yet the spokes might be screwed into a hub like cycle practice. The combined wood and metal rim possesses a certain amount of elasticity, which, combined with a long bearing spring, ought to answer fairly well for heavier vehicles. These, of course, are only suggestions, but I think they indicate the lines which should be followed.

A New Method of Ignition.

In his recent lecture before the Society of Engineers, London, Eng., J. D. Roots touched upon the subject of ignition. He said:-

"With regard to the vexed point of electric ignition and tube ignition, the author would observe that during 1885 he made numerous experiments with two forms of electric ignition upon a stationary spirit-engine, viz., a battery and a magneto-electric machine. The ignition tube was also fitted to the same engine. Better results were always obtained with the tube than with either method of electric ignition. He therefore gave up electric ignition, and has always placed his trust in the tube, which he is still convinced has the balance of advantage in its favor. It must be conceded that electrical ignition generally is in a much improved condition to what it was at the time he experimented with it. Nevertheless, both are destined to be superseded in the immediate future by another system of ignition, which has all the advantages of both systems and some of its own. This method consists of the use of a small additional piston, which fires a small quantity of the charge by compression prior to and separately from the main working charge, and admits it to the working-cylinder at a predetermined time, which can be varied at will. This method of ignition is not, however, sufficiently perfected to be described further at present."

Some New Water-Circulating Pumps For Gasolene Motor Vehicles.

In order to keep up a rapid circulation of cooling water to the cylinders of petroleum-spirit motors a pump of some description appears to be an absolute necessity, troublesome though some of these attachments have proved. Several new types of pumps, said to be specially suitable for application to motor-vehicles, owing to their simplicity and relative small size, have recently made their appearance on the market. Among these is the "Abeille" centrifugal pump shown in Fig. 1, lately introduced by Messrs. Dalifol and Thomas, of 183 bis Faubourg Saint-Honoré, Paris. As will be seen, it comprises but few parts. On the shaft is a disk D, provided with projecting vanes. The shaft and disk are rotated by means of the small pulley driven by the motor, either by means of a strap or by frictional contact with the fly-wheel. The principal claim made for the "Abeille" pump is the facility with which it can be taken apart without interfering with the connections of either the inlet or outlet pipes A B. To remove the cover C with the disk D and shaft from the body of the pump it is only necessary to unscrew four bolts.

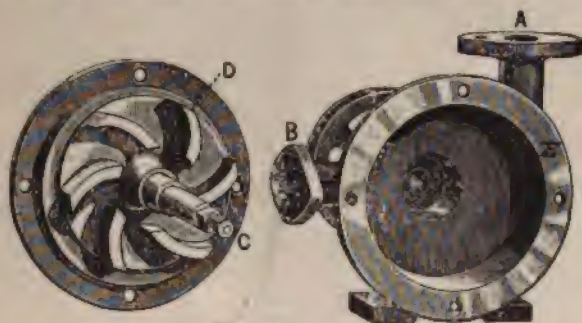


FIG. 1

Another improved rotary pump has lately been devised by M. Julien and made by M. G. Benoit, 119 Rue St. Maur, Paris. It is illustrated herewith by the two sectional views, Figs. 2 and 3. The piston forms the essential feature of the new pump; it comprises a short screw b, on which the thread or direction of one-half is contrary to that of the other half. The screw

is mounted on the rotating shaft e, which runs in suitable bronze bearings. The screw is cast in one piece with a circular wall g which divides the cylinder into two portions, each part having communication with the admission and outlet pipes b c. Extending through the cylinder walls on each side of the dividing wall g are two special flat-faced bolts i, the use of which is to prevent the rotation of the water at that portion of the cylinder. When the pump is put in operation the heated water is drawn in from the walls of the cylinder of the motor, and driven towards the center of the pump cylinder, at a

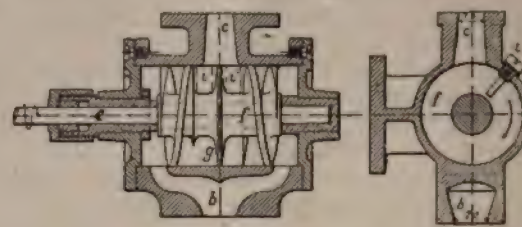
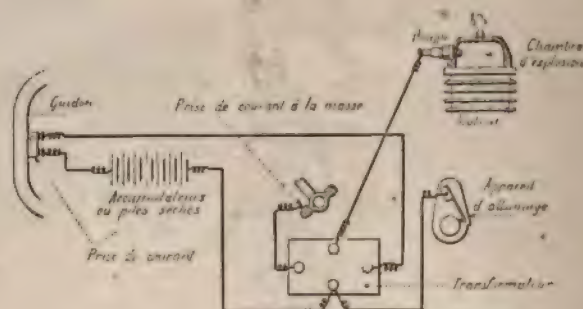


FIG. 2 AND 3.

pressure proportional to the speed of the rotation of the pump. When the water meets the dividing wall g its direction is diverted, and meeting the pieces i it is caused to pass upwards through the outlet pipe c. The pump can also be run in the reverse direction, and employed in maintaining a supply of cold water to the water jacket of the motor. It will also, it is claimed, work equally well with heated water, even up to a temperature exceeding 100° C. At a speed of from 2,000 to 2,400 revolutions per minute, and a difference in height of 3¼ ft., a pump with a 60-mm. diameter cylinder will, it is stated, circulate from 500 to 600 litres of water per hour. The pump only weighs about 8½ lbs., and by the use of aluminum in certain of the parts M. Julien hopes to reduce the weight to less than 4½ lbs.—*Motor Car Journal*.

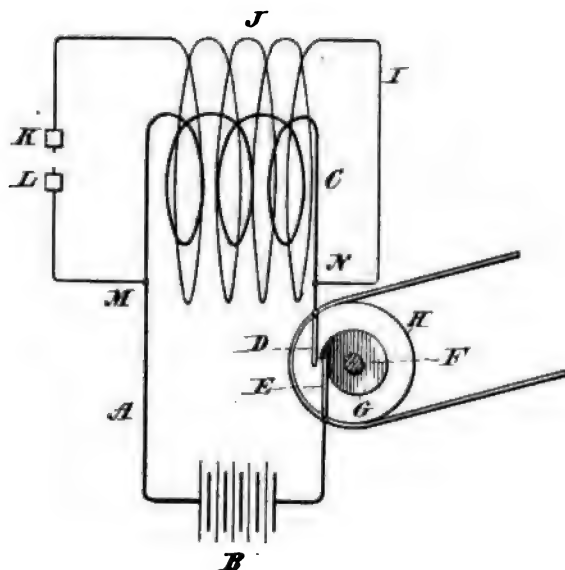
Ignition Plan of the Barriere Tricycle.

In this tricycle, described in a recent number of *La Locomotion Automobile*, the spark is produced by means of a special cam and spring, enclosed in a small aluminum case, but without vibrator, platinum contact points or regulating screw. The in-



duction coil, ordinarily employed, is replaced by a transformer operated from either dry or storage batteries and giving a current of four or five volts. The plug is also new. The metallic tige protected by unbreakable porcelain, prevents short circuit. A special coating obviates injury from moisture.

referring to the matter therefore, broadly, it has hitherto been regarded as well settled that with an induction-coil of given proportions and a source of current of given power it is not possible to produce a spark of as high intensity without the buzzer in conjunction with the circuit-closer as with it. On the other hand, it is also well-known that the presence of the buzzer is objectionable for several reasons, among which may



be mentioned rapid oxidation and burning of its contacts, waste of current energy thereat, and its rapid deterioration, so that the apparatus might become inefficient in its working at any instant which could not be foreseen. This uncertainty may especially occur in circumstances where the buzzer may be enclosed. Hence the effective lifetime of the apparatus rests upon the continued integrity of the buzzer rather than upon that of the other associated parts.

"We have discovered, and we believe the discovery to be in every sense broadly new, that we can eliminate the buzzer entirely and produce powerful and efficient sparks adequate to any purpose of electric ignition as now practiced in the arts by means of an induction-coil having in the circuit a simple make-and-break circuit-closer, switch, or commutator. We accomplish this by constructing our induction-coil so that the secondary thereof is placed in shunt relation to the primary, and we arrange the spark-terminals in the secondary circuit. We prefer also to arrange our circuit-breaker in such a way as that a single rapid break is produced after a relatively long period of closure, this period being sufficiently long to enable the current to reach its full value before the rupture determining the spark is made. We have practically constructed this apparatus, and we have used it upon a gas-engine, and we have thus demonstrated its thorough efficiency in apparatus of that kind; but its employment in gas-engines is only one embodiment of it, and we do not limit ourselves to such an embodiment, but desire it to be distinctly understood that we claim the invention, broadly, for any and all uses and in any and all apparatus in which it may be advantageously employed.

"The accompanying drawing is an electrical diagram illustrating the various parts and their relation symbolically.

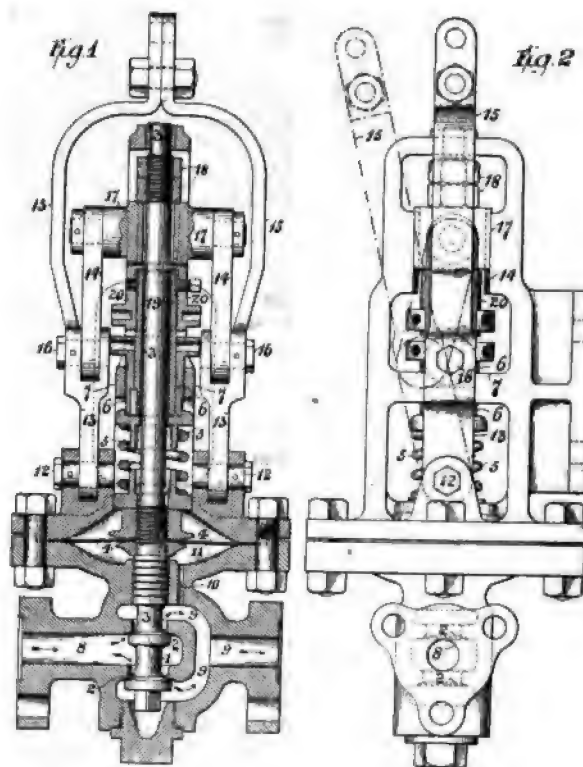
"A represents the primary circuit, in which is the source of electricity B and the primary coil C. Included in said primary circuit is a circuit-breaker, which may consist of a fixed

contact D and a spring-contact E, normally separated. Acting on the spring-contact E is shown a cam F on a rotary shaft G, which shaft may be rotated by the pulley and belt H. At every rotation of the cam G the spring E is brought into contact with the plate D, thus closing the circuit, or, in other words, the circuit is made and broken at each rotation of the cam G. We do not limit ourselves to this particular form of mechanical circuit-breaker.

"I is the secondary circuit, which includes the secondary coil J and the terminals K and L, between which is the gap over which the spark passes. The terminals of the secondary circuit are shown as connected to the primary circuit at M and N, so that the primary and secondary coils are therefore in shunt relation. It is not essential that the connection should be made at the precise points M and N, but the primary and secondary coils may be connected at any point so long as the shunt relation between them which we have pointed out is observed."

No. 625,324—Valve for Air Motors—James Craig, Jr., New York, N. Y. Application filed September 16, 1897.

This improved valve combines the functions of throttle, reduction, and extension valves and in such a manner that the valve can be quickly and easily operated.

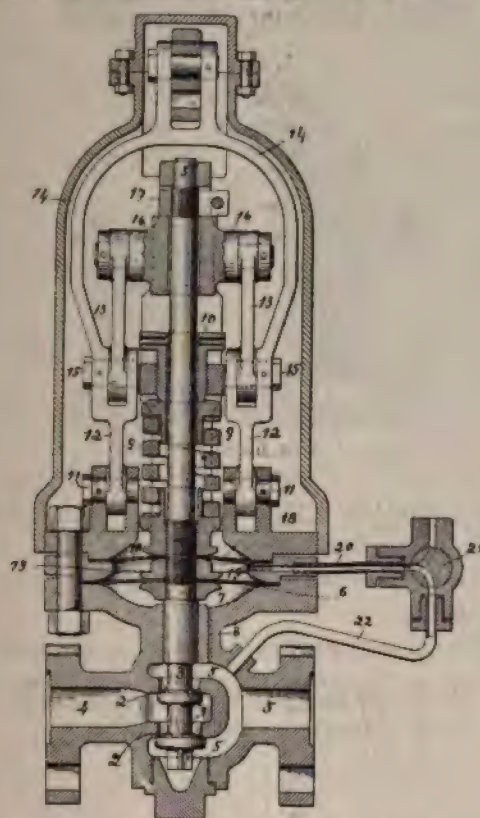


Claim.—In a reducing-valve apparatus for air-motors the combination of the reducing-valve, valve-stem operating the same, toggle mechanism controlled by the operator, and a member connected with the valve-stem and arranged to engage with the toggle mechanism whereby the reducing-valve is closed and held on its seat.

No. 625,325—Reducing-Valve for Air Motors—James Craig, Jr., New York, N. Y. Application filed March 25, 1898.

Claim.—In a reducing-valve for air-motors, in 15 combination, a diaphragm 6, arranged to operate the valve; a diaphragm 18 of less effective area, also arranged to operate the

valve; spring 9 adapted to act upon both diaphragms to open the valve chambers 19, between the diaphragms, and means by which the chamber is caused to communicate with

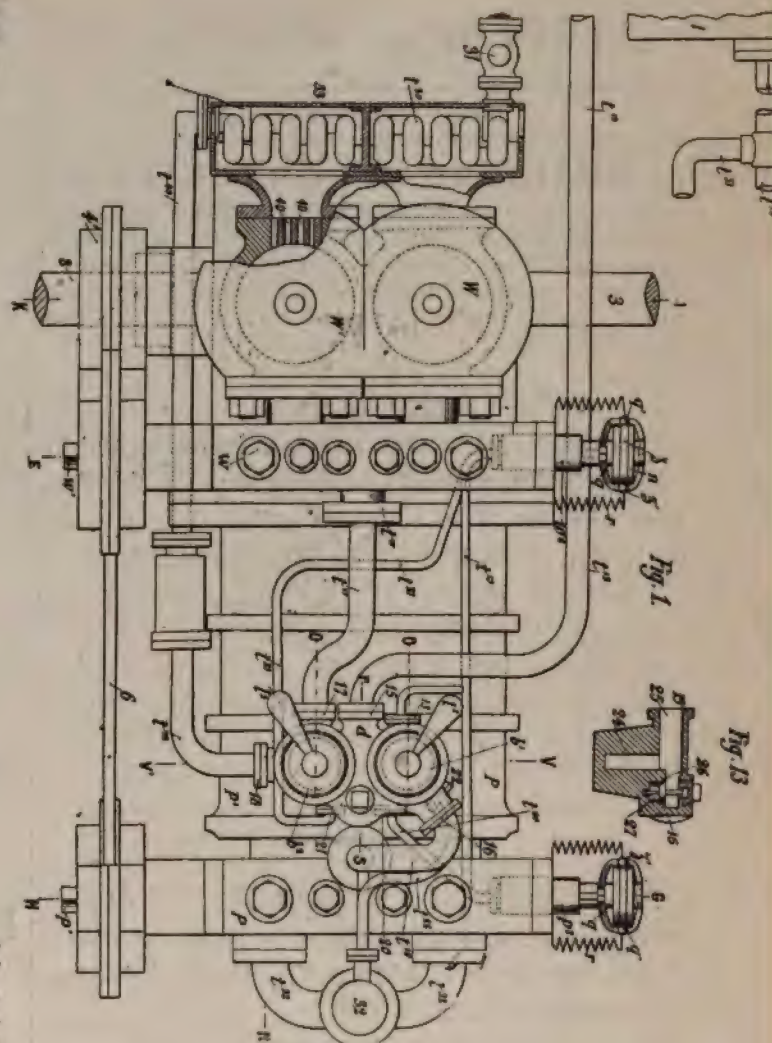


the outside air, whereby the valve is operated by diaphragm 6, or with the delivery-port, whereby the valve is operated by diaphragm 18 and the delivery-pressure of the valve increased.

No. 625,416—Carbureted Air or Other Fluid Pressure Engine—Levin Louis Revel, Havre, France. Application filed August 18, 1898.

This invention is said to present the following advantages: First, the possibility of varying, by means of the admission, the pressure of the explosive mixture at will, and consequently the power and speed of the motor; second, the possibility of starting the motor directly by the admission without the assistance of external appliances, such as levers or cranks, and that independently of the position of the organs which receive the motive fluid, the starting being either instantaneous or slowly increasing in speed, as desired; third, the possibility of reversing the engine directly by means of the admission appliances; fourth, marked reduction in the heating of the walls of the cylinders; fifth, possibility of performing all the operations required by means of a simple distributor.

Four cylinders are employed, arranged in pairs in two planes at right angles to one another—for example, two horizontal cylinders and two vertical cylinders—the axes of the cylinders being at the intersections of two planes at right angles to one another, with the two planes parallel and normal to each of the preceding. The pistons of these cylinders are attached by their connecting-rods to cranks arranged at 180 degrees with one another on the main shaft of the engine in such a way that one at least of the four pistons is always behind the dead-center. The application of this arrangement to explosion-motors is claimed to be entirely novel. It is



rendered possible by combining the four cylinders with a reservoir or accumulator of air maintained constantly under pressure by the motor and capable of being brought into communication with each of the said cylinders at any moment by means of a distributor. The four cylinders may consequently be driven in this way by the compressed air from the accumulator, which enables the engine in any position to be started in either direction. Two of the cylinders are arranged, for working normally with the carbureted air (explosive mixture.) This air, always drawn from the accumulator and being under pressure which may be varied by means of the distributor, passes to the cylinders through a carbureter. The two other cylinders may work when desired as a starting-motor (in this case they take the air under pressure from the reservoir or accumulator) or as a single-acting pump when the motor is running normally for establishing and keeping up the pressure in the accumulator. The combination of four cylinders, placed in pairs at an angle of 90 degrees, with a regulating reservoir and accumulator capable of furnishing at any moment the fluid for actuating the four cylinders in the form of compressed air for permitting the starting in any position or direction, two of the cylinders receiving the fluid in the form of carbureted air and the two others, after having served as motors for starting, acting as pumps for producing the pressure in the accumulator, constitutes the novel principle characterizing this invention.

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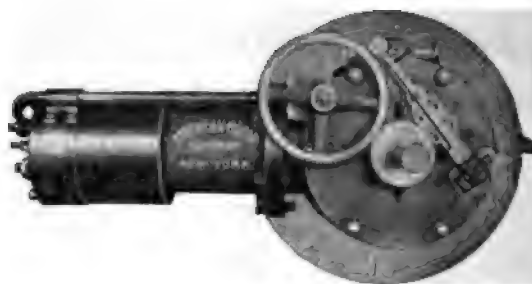
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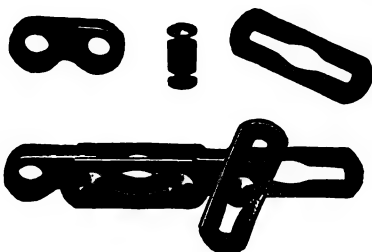
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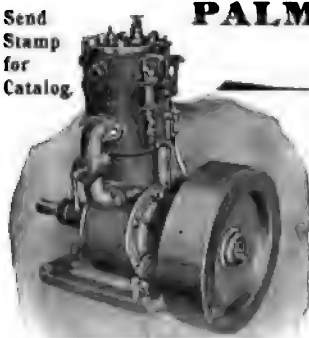
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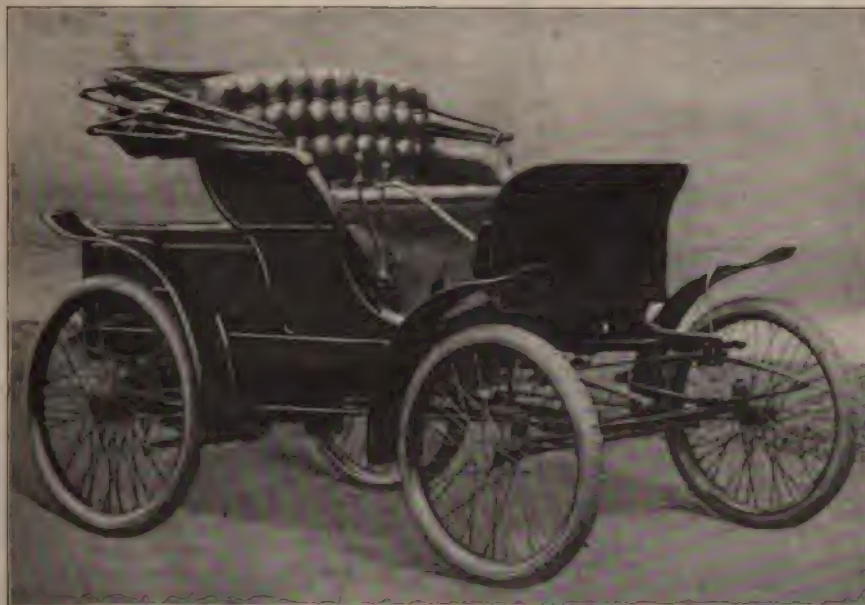
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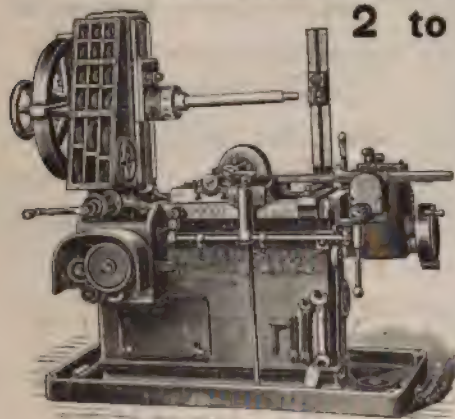
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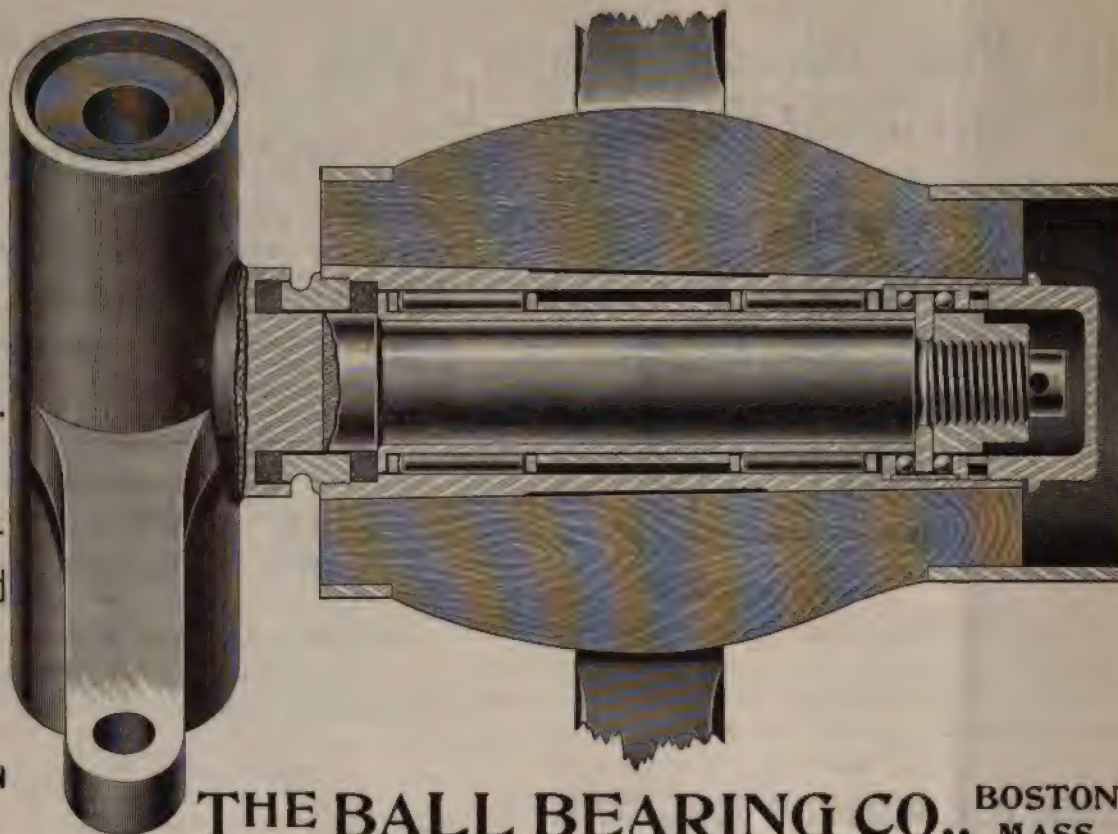


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common speech because of its length and its foreign parentage. Practical men who seek to convey their meaning in the fewest possible words, and those the plainest, will not weary their tongues with "words of learned length" and foreign derivation.

The other verbal inventions thrust upon the public are even less happy in their origin and destiny. They are for the most part barbarous Greek and Latin compounds, smelling strongly of the study, and wholly unfitted for the workaday world. Their currency is local and ephemeral, and they will inevitably give place to terser and more intelligible terms, just as complicated motors and vehicles are found inadequate in service and are displaced by the simpler forms, better adapted to the wear and tear of use.

The ultimate terminology of the English speaking world will be the motor terminology, from which the verbs and nouns will be freely, if not elegantly, derived; and while literature may adhere to the many syllabled forms, commerce and sport will prefer the shorter and more direct.

The Electrical Exhibition.

The Electrical Exhibition, which closed last Saturday night, could scarcely be called a favorable presentment of the great electrical industry in the United States to-day. Many of the principal companies engaged in the business were not represented, probably because they felt that the public had been sated with electrical exhibitions, and that it would be a useless expenditure to participate. The attendance was not large, and the chief center of attraction was the motor vehicle exhibits, which filled the main aisles, and were certainly a most promising omen of future exclusive motor vehicle exhibitions, which shall even surpass the electrical exhibitions in éclat.

The electric vehicle exhibitors, however, state that they were well satisfied with results, as everything drifted their way.

Charron's Challenge.

Much has appeared in the press during the past few days about M. Charron's acceptance of Alexander Winton's challenge to race either in France or America for a large purse. Mr. Winton wishes the race to be run in America, and will build a special machine for the occasion, the route spoken of being from Chicago to New York, a distance of over 1,000 miles by road. If a race is to be run, it would certainly be conceded that Mr. Winton should use a new carriage instead of the two-year-old model which took him over the road from Cleveland to New York recently. In fact, both contestants will undoubtedly choose special machines, higher powered than normal and having other devices favoring high speed, a

fact which goes to prove what has all along been claimed by the editor of THE HORSELESS AGE that the motor racing machine is a special type constructed for this purpose and unfitted for ordinary use. Mr. Jenatzy's racing boat is an excellent example of this practical uselessness.

New England Automobile Club.

A meeting is to be held in Boston this week for the purpose of organizing a New England Automobile Club, the object of which will be to promote discussion on motor vehicle subjects, and to have a paper read each month by a member or outsider on some important branch of this rapidly increasing industry.

John Hector Graham, of the Graham Equipment Co., W. B. Weston and D. S. Lundin have held a preliminary meeting and prepared a constitution and bye-laws.

Riker Electric Dos-a-Dos.

A very elegant type of electric vehicle is the Riker electric dos-a-dos, herewith illustrated, made for Whitney Lyon, one of the leading spirits in the organization of the New York Automobile Club.

The general design is that known as a sporting trap. The tread is 56 in. and the wheel base 63 in. The wheels are 32 and 36 in. respectively, fitted with 3 in. pneumatics. One Riker 2 K. W. motor is used. The total mileage on one charge on level macadam road is 25, and the maximum speed is 12 miles an hour. The controller gives three speeds ahead and two to the rear. There is a combination voltmeter and ammeter and electric side lights. The vehicle carries four passengers and weighs 2,500 pounds.



RIKER ELECTRIC DOS-A-DOS.

Some Very Light Gasolene and Steam Motors.

By A. M. HERRING.

Fig. 1 is a view of a balanced, high speed gasolene motor used for experimental purposes, connected with a flying machine. As here shown it is mounted in a testing frame, where it drives two screw propellers of opposite pitch in opposite directions, the rear propeller being mounted on a continuation of the main shaft, whereas the front propeller is driven in the reverse direction by means of the gearing seen at the back. This motor in part only is of extremely light construction. It is jacketed with an oil jacket which in turn is cooled by wire solenoids soldered fast to its surface. The oil gives a sufficiently rapid conduction of heat to the solenoids to prevent overheating of the cylinders. The chief function of the oil jacket, however, is to control the lubrication, for as the temperature rises it forces an increasing amount of lubricating oil around the pistons. This motor has plain electric ignition (not "jump spark") with an automatic lead capable of bringing the time of ignition five-eighths of a stroke before the motor reaches the dead center. The spark coil employed is shown on top of the testing frame. Its weight is 21-100 pound. Figs. 2 and 3 show the same motor working a seven-foot three-bladed propeller. Only one cylinder is here operative. Fig. 3, showing the motor driving the propeller several hundred revolutions a minute, was made for the purpose of illustrating the small amount of vibration produced. The vibration is, of course, nearly all due to the recoil from the explosion, rather than from the reciprocation of the pistons and connecting rods, for these are exceedingly light, the pistons weighing only about 6-10 of a pound ($3" \times 3"$ motor), and the connecting rods 34-100 pound each. The pistons of the two cylinders move in opposite directions and are balanced within .02 pound. The testing frame is elastic or, at least, the mounting of the motor is, so that when the explosion occurs the motor is free to rotate a few degrees in the opposite direction to which it drives the shaft, and no matter how perfectly the motor may be balanced this recoil is always noticeable so long as the motor drives one shaft alone, but when both propellers are mounted, the recoil is taken up by the front propeller on the upper or secondary shaft and nearly all the vibration disappears. The single propeller, seven feet in diameter, weighs three and three-quarters pounds—a rather light but very effective fly-wheel. The combined weight of the two spruce propellers is about six and a half pounds. The compression is high, so that when warm the engines ignite spontaneously.

LIGHTEST ENGINE FOR THE POWER EVER BUILT.

Fig. 4 represents Mr. Herring's latest and lightest steam engine; built almost exclusively of tool steel, for the most part tempered and ground to size and fit. This engine is one of a pair for a flying machine and is of interest to the mechanically inclined in that it is in all probability the lightest engine for its power ever built. Its entire weight, including mica and asbestos lagging, steam pipe coupling and the braces which hold it in place on the flying machine, is less than two and three quarter pounds, and it is capable of exerting over seven brake horse-power. It is designed for a boiler pressure of 240 pounds per square inch and any speed up to 2,400 revolutions a minute. In order to obtain such speeds the weight of the piston and piston rod was cut down to the minimum.

The piston is of tool steel, hollow and provided with two carefully fitted cast iron rings. The piston has domed heads and was made in two pieces, which were separately turned up from a solid bar and afterward brazed together and to the hollow tool steel piston rod. The average thickness of the piston is less than $25\frac{1}{1000}$ inch and its entire weight less than .07 pound, although it is two inches in diameter and about one inch long. The valve is of the balanced piston type, fitted with four steam-tight rings; it is one inch in diameter and has ports around its entire circumference. The steam ports form a part of the cylinder heads which screw on. A head belonging to another engine may be seen in the same view. These ports provide a passage for the steam which at its most contracted part is equal to twenty-four per cent. of the piston area. A valve ring and a piston ring, together with a six-inch box-wood scale, are shown in the same view. By examining the upper cylinder head one may see the threaded joint, to which a small cylinder may be added in order to convert the engine into a tandem compound. This portion has not yet been tested. The engine was designed solely for the flying machine, which needs neither variable expansion nor reverse gear. Al-



FIG. 1. OIL-JACKETED GASOLENE ENGINE.



FIG. 2. ONE CYLINDER ONLY IN OPERATION. MOTOR, 3' X 3'.

though the main bearings, including the lower end of the connecting rod, are all hardened ball bearings, the engine is hardly suitable for motor vehicle work because so much of the working mechanism is exposed to dust and the main parts are proportioned only for a steady and uniform transmission of the power developed, but when so used they have an ample factor of safety.

The cylinder heads and ports are made by brazing together two steel plates, which are formed into egg-shaped "pill boxes," their holes corresponding to the cylinder head and the valve cases are filled in with the cylinder head proper, and (the smaller hole) with a steel bushing having ports cut at intervals all around its circumference; a similar perforation of the straight sides of the head provides passage for the steam. All of the brazing, which represents thirty-two lineal inches of seam on each head, is accomplished at one heating.

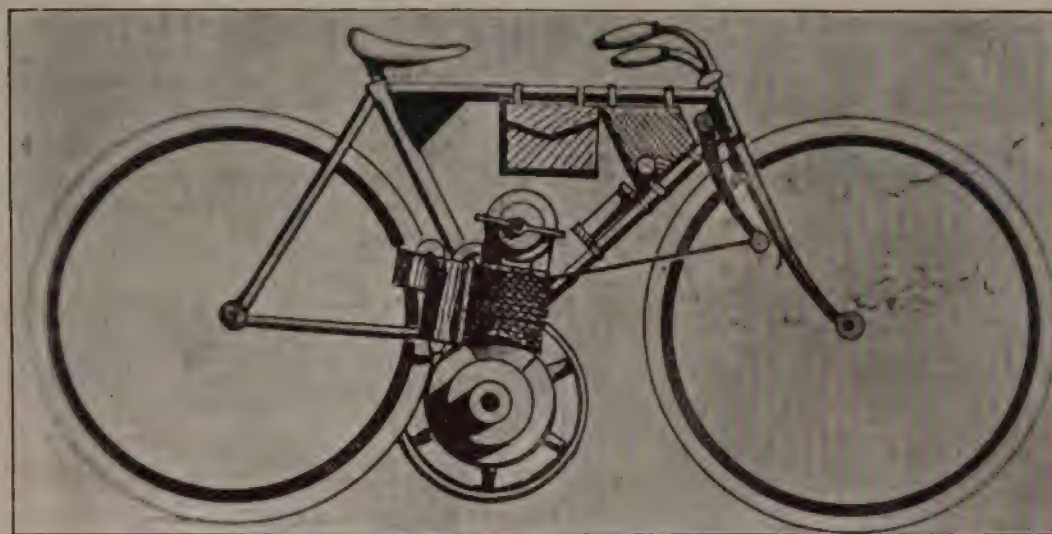
THE MOTOR BICYCLE.

Fig. 5 shows the motor bicycles now under construction. The motor is of the Otto cycle type and has a considerable surplus of power for even the maximum speed at which it is geared, so as to be able to do away with the pedals entirely on even the poorest roads. The combustion chamber is partly spherical, with no passages or pockets, as the valves head directly into it. The ignition is "break contact," not "jump spark." The actual breaking of the contact in the combustion space is automatically controlled by a governor in such a way that as the speed of rotation increases the break occurs farther and farther ahead of time. This ensures a very much greater mean effective pressure and consequently more power from a given size of motor at nearly all speeds, but particularly at high ones, because the full pressure occurs during the working stroke instead of at the end of it, as in the case of a motor running 500 or 600 revolutions a minute, which ignites the mixture just as the piston reaches its highest point. It is not generally appreciated by experimenters, or for that matter even by builders of gasolene engines, how much power is wasted by igniting too late. For example, a small engine (2" x 2 1/4") was fitted with a "dead center" igniter and its maximum speed was only about 630 revolutions a minute with



FIG. 3. ONE CYLINDER IN MOTION. 300 TO 400 REVOLUTIONS.

FIG. 4. STEAM ENGINE OF TOOL STEEL 7.06 BRAKE H.P.
WEIGHT, 2 1/4 LBS



MOTOR BICYCLE. WEIGHT, 100 LBS.

the best regulation of mixture, but as a rule it was a difficult matter to get it to run idle at a speed of over 500 revolutions a minute, but at this speed and with a rich mixture the maximum brake test showed a mean effective pressure of less than fifteen pounds per square inch. The same engine, igniting one-tenth of a revolution ahead of time, gave a mean effective pressure of twenty-six pounds per square inch at the same speed. This leading of the time of ignition is effected by hand on the De Dion & Bouton motors, and as it is not automatic it is liable to stall the motor should its speed be slowed down by some other cause beyond a certain limit. Nevertheless it is a valuable feature and would be very much more so were it not dependent upon the use of the jump spark with its entailed difficulties of leakage and short circuit caused by such high potentials.

One of the greatest troubles to the novice (or even the expert) with the usual vehicle motor is the constant regulation of either the air or gasoline supply necessary in order to produce a proper explosive mixture. For the new bicycle motors this is effected automatically in a very simple manner, which depends in its theory upon the relation of the vapor tension to the film tension of the gasoline at various temperatures, so that even considerable variation in quality of the gasoline used necessitates no change in the adjustments made on the regulator before the machine leaves the shop.

By reference to the cut it will be seen that the motor is placed on one side of the frame, whereas the fly-wheel is on the other—between the two are located the change gears and the small igniting dynamo especially designed for the purpose of furnishing ignition for vehicle motors, and considerably lighter than any similar effective machine on the market. It is dust-proof and was built by the Saranac Electric Co., of St. Joseph, Mich., from designs of Harry Ray.

Near the front forks are two levers with pedals or foot rests on their lower ends. The motor is controlled entirely from these rests, pressure on the right pedal throwing the motor in and out of friction mesh, allowing any proportion of slip desired and consequently any speed from zero (with the engine running idle but under governor control, up to the

maximum may be obtained at will, dependent solely upon the pressure and position of the pedal. The left pedal is used for changing the ratio of the gearing from the ordinary to the slower one used for hill climbing or for sandy stretches of road. By careful observation it was found that on roads around these sections very few opportunities were offered for runs at higher speed than sixteen miles an hour and that the average country road permitted speeds of only about twelve miles, so that the gearing and the cut out governor are proportioned to the latter velocity, but by tightening the governor this speed may be practically doubled if desired. The machine is started by mounting from the back step, kicking along the road to get a start, and after the seat is reached the motor is thrown into gear by the right pedal, after which it continues to run automatically until shut off. On down grades the motor may be thrown out of gear and stopped until near the bottom of the hill, when it may be started again without fear of miss simply by being thrown into mesh again. The motor has ample power for all grades that can be climbed at all by the ordinary bicycle. My object in building a motor bicycle instead of a tricycle or voiturette was to produce a machine which should become available on all roads and paths, because the motor vehicles of wider tread are of little use on nearly seventy per cent. of our country roads, unless provided with very powerful motors, which render the vehicle too costly for many purchasers and too heavy to be easily handled on very steep hills or when stuck on very bad roads.

These motor bicycles are being built of the very best material and by the most skilled labor and will be fully guaranteed. The fuel (store gasoline) that may be carried will be sufficient for from four to ten hours' run, as desired. Where the dynamo ignition is used, the battery is dispensed with entirely, even for starting. All of the main working parts are ball bearing, enclosed in oil and dust-proof cases, which are sealed up to prevent unnecessary tampering with them. The motor is self-oiling, one supply lasting for a day's run. Owing to limited facilities only a comparatively few machines will be produced this season.



GASOLINE RUNABOUT. PITTSBURGH MOTOR VEHICLE CO., PITTSBURGH, PA.



MOTOR PACING MACHINE OF THE WALTHAM MFG. CO. DE DION GASOLINE MOTOR.

Pittsburg Runabout.

The Pittsburg Motor Vehicle Co., Pittsburg, Pa., have just completed a handsome gasoline runabout, which we illustrate.

The wheel-base is five feet and the gauge four feet six inches, the object of making the gauge slightly under the standard being to prevent the vehicle from running in the ruts made by ordinary wagons. The wheels are of the suspension type, using heavy wood rims and two and a quarter inch pneumatic tires, bolted on. The frame or running gear is made up entirely of steel tubes with brazed joints. The rear axle is encased in a steel tube and runs on encased ball bearings. The ordinary hub steering device is used, with a friction clip which prevents the handle from being jerked out of the hands of the operator, and also enables the rider to run along without keeping his hands constantly on the handle. The transmission to the rear axle is by means of a heavy nickel steel chain and sprocket.

The motor has two cylinders and no water jackets. It is started by a small lever from the seat, avoiding the use of a large crank on the outside, which users of gasoline vehicles object to. No oil cups or lubricators are needed, as the flywheels, gearing, etc., run in a bath of oil. The weight of the motor, which develops three H.P., is 130 pounds. The total weight of the vehicle is a little over 400 pounds. The motors are hung horizontally in the body on separate springs, no parts being exposed to view except the muffling device. An "electric governor" regulates the speed of the motor.

Ignition is by an electric spark of new and improved form. There are but two levers controlling the vehicle, one for guiding and the other for stopping, starting and changing speed. Two large band brakes, operated by a small foot lever, keep the machine under perfect control. These band brakes are applied to the rear axle direct instead of being placed on a counter shaft, thus taking all strain from the motor and working parts. A very low gear is employed for hill climbing and a direct gear for level roads. The speed range is from three to eighteen miles an hour. The manufacturers state that the machine has been thoroughly tested and that they are making a specialty of it, and as all parts are interchangeable, with special tools and machinery, any broken parts can be replaced at small cost. The price of the machine complete is \$500. A buggy top can be put on at small additional cost to adapt the machine for a business man's or physician's use. Acetylene lamps are used.

Kokomo to New York Now.

The Haynes-Apperson Co., Kokomo, Ind., who have about completed a gasoline carriage for Dr. A. A. Webber, of Brooklyn, N. Y., have arranged with the doctor to run the vehicle from Kokomo to New York against time, a distance of about 1,000 miles.

If any damage is sustained en route it will be assumed by the manufacturers, who hope to surpass all previous road records in the United States.

The Haynes-Apperson Co. find it necessary to run their factory twenty-four hours a day with a double turn of men. They recently sent a carriage overland to Grand Haven, Mich., a distance of 280 miles, which was covered in twenty-six hours and ten minutes. The machine has a capacity of

ten passengers, including the trailer, and fourteen or fifteen can be accommodated, as the seats are fifteen inches wider than those of the standard carriage.

They are building several machines for the Pacific Coast, one of which is for use on long trips into the gold mining districts of Washington and Idaho.

The Haynes-Apperson Co. are now doing all their own woodwork and will soon have their own paint and trimming shop, so that all parts will be made under their roof.

The motor mail wagon for Porto Rico has been received by the consignee and is now in service.

Exclusive Privileges Denied.

A petition on the part of the Suburban Electric Carriage Co., Buffalo, N. Y., to secure the exclusive privilege of operating motor vehicles on all west side boulevards and parks under the control of the west park board has been denied. Similar action was taken by the south park commissioners.

The communication stated that the vehicles were to be operated for the benefit of passengers, to run on all boulevards controlled by the west park board and through all the parks, the right to extend twenty years from the date of the granting of the permit. The motor vehicles were to be operated by storage batteries. Ten passengers could be accommodated and the vehicles were to start at intervals of not less than one hour. The company, however, reserved the right to operate them up to midnight if it seemed necessary, the regular hours being from 8 o'clock in the morning until 9 o'clock in the evening, and to withdraw the vehicles on inclement days and during the winter months. The company promised the west park 2 per cent. on the gross receipts.

Terminal Delivery Service.

The very newest project of the indefatigable promoters of the New York Autotruck Co. and the General Carriage Co. is a terminal transfer trust under the charter of the latter company, and with a capital of \$200,000,000. The chief business of this company will be the collection and delivery of all kinds of freight in all the large commercial centres of the country, competing with express companies and cutting under their rates.

A further extension of the business will include the proper billing of freight to its destination, relieving shippers altogether of the trouble from the time the goods leave their doors, and making one charge for the entire service. The company is empowered to employ any kind of motive power and to engage in any branch of the transportation business.

Stanley Bros. Sold Out.

It is reported that Stanley Bros., Newton, Mass., have sold out their steam carriage business to John Brisben Walker publisher of the *Cosmopolitan Magazine*, and that the plant will be moved to Irvington-on-the-Hudson, where Mr. Walker's magazine is published.

LONDON NOTES.

INCREASING INTEREST IN GERMANY.

Increasing interest is being displayed in motor vehicle matters in Germany and automobile clubs are springing into existence in all the large towns. The recently-formed West German Automobile Club, with headquarters at Aix-la-Chapelle, inaugurated itself as it were on the 14th of May by a motor vehicle race from that town to Coblenz, via Cologne, a distance of about ninety-three miles. The race was won by Herr Ehrhardt, director of the Eisenach Fahrzeugfabrik, of Eisenach, on a "Wartburg" gasoline carriage, constructed by that company, his time being six hours and fifty-eight minutes.

STEAM OMNIBUSES FOR BELGIUM.

Some experiments have just been carried out in Brussels with a "Lifu" steam omnibus, of the type constructed by the Liquid Fuel Engineering Co., of Cowles, Isle of Wight. The trials, which were carried out by the Compagnie des Tramways Bruxellois, were made on the Bourse-Ixelles route, which includes the steep thoroughfare known as the Montagne de la Cours, which has a nine per cent. gradient. The trials are reported to have been most successful, and it is probable that a public service of steam omnibuses will be adopted on the route in question early next year.

ELECTRIC OMNIBUS SERVICE AT BELGIUM.

Some trials have just been carried out in the German capital with a new electrical omnibus. The vehicle, which has accommodations for eighteen persons, exclusive of the driver, weighs about three and one-half tons. The battery of accumulators is stated to have a capacity of a run of from ten to twelve miles. It is arranged under the seats of the carriage in such a way that it can, when exhausted, be quickly substituted by a fresh battery. There are two electric motors which are geared to the rear wheels through spur wheels. The trials are reported to have been very successful, and it is said that arrangements are in hand for the starting of a service of such vehicles in Berlin.

PARIS-BORDEAUX RACE.

The event of the week in French motor circles has been the race between Paris and Bordeaux, a distance of a little over 25 miles. So far only telegraphic accounts of the race, which was run off on Wednesday, the 24th of May, are to hand. The race was divided into two categories—motor carriages and motor cycles—there being twenty-eight starters in the first and thirty-seven in the second section. The race was won by Charron in the unprecedented time of eleven hours, forty minutes and twenty seconds, representing a speed of slightly over thirty miles an hour for the entire distance. The previous record was fifteen hours, fifteen minutes and thirty-one seconds, or three hours, thirty-five minutes and eleven seconds slower than Charron's time. The second place was taken by M. René de Knyff, whose time was eleven hours forty-six minutes, or only five minutes forty seconds more than that of Charron. It is noteworthy that the first two to arrive rode on petroleum-carriages, fitted with twelve H. P. motors, built by Panhard & Levassor. The race was attended by quite a series of accidents. Only five miles from Paris two carriages came into collision, and one of the engineers was thrown violently out. He was not much hurt, but his employer decided not to continue the race. At Versailles a spectator is reported to have fell down dead from excitement on seeing one of the competing cars nearly capsize when rounding a curve at great speed. One of the large

THE HORSELESS AGE.

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est carriages overturned at Vendome, and was much damaged, but the occupants escaped unhurt.

TRAINING SCHOOLS.

The Austrian Automobile Club, of Vienna, has just organized a class for the training of motormen. The class will be divided into two sections—technical and practical, efficient teachers being provided in both sections. Would-be motormen have to pay three gulden for the course, and gentlemen automobilists will be allowed to attend, the fee in their case being five gulden for the course. The club will issue certificates of proficiency to motormen attending the course.

THE ELECTRIC CABS.

The reappearance of the vehicles of the London Electrical Cab Co., Ltd., on the London streets, which was announced for the Queen's birthday, the 24th of May, duly took place. The day was, however, not without its incidents, for at one time no less than seven cabs were lined up in Farringdon street, E. C., in a state of more or less disablement. It is, however, only fair to state that this was in no way due to any fault in the vehicles, but to the negligence or want of experience on the part of the drivers. As I mentioned recently, there is quite a demand for motor-vehicle drivers in this country, and the cab company have found it no easy matter to procure efficient drivers for their eighty vehicles. None of the breakdowns above mentioned were of a serious character, and with a little more experience on the part of a few of the drivers, the service will be quickly in working order.

TERMINOLOGY.

A good deal of discussion is just now taking place in motor circles in England as to the names to be adopted in respect to automobiles and automobiling. This week A. Shippy, member of the firm which controls the rights of the Riker electric vehicles in the United Kingdom, has sent a long letter to the English press in which he makes a number of suggestions as to what are, in his opinion, suitable terms. For vehicles propelled respectively by electricity, petroleum, steam and compressed air, he suggests these distinctive names—"electromobiles," "petromobiles," "steamobiles" and "aeromobiles." To further specify the character of a vehicle he suggests employing the first part of the foregoing as a prefix, as for example—"electro-cab," "petro-van," "steam-wagon," and "aero-victoria," etc. Further suggestions are—"motorette" for all three-wheel motor-vehicles, "motoring" as a parallel to yachting, cycling, hunting, etc., "motorage" as an equivalent to the French word *garage*, or stable for motor vehicles; "motor-carist," or "motor-man," for paid drivers, and "automobilists" for gentlemen drivers. There is no doubt much need of some degree of uniformity in horseless vehicle terms, but whether suggestions made by Mr. Shippy will be adopted remains to be seen.

LIST OF EXHIBITORS AT THE TUILERIES.

The following is the list of exhibitors who have thus far taken space for the motor vehicle exposition at the Tuileries:

Etablissements Pieper, Société, des coussins et sièges à ressorts; Thélén, Mégevand et Cie; Kossuth et Cie; Hector Gérard; Société Le Carbone; Dorard et Baule; Renault frères; Ducroiset et fils; Garin; Société Le Progrès; A. Loyal; Compagnie Dunlop; Fritscher et Houdry; Société de mécanique industrielle d'Anzin; Chevalier, Thevard et Cie; R. Varrall, les Fils de A. Deutsch (de la Meurthe); C. Fournier; Francq-Valéry frères; Falconnet, Perodeaud et Cie; A. Soly; Société L'Universel Acétylène; Desponts et Godefroy; Rassée et Michel; Monier, May et Cie; Roux frères et Cie; Joseph

Edouard Menessier; P. Dorigny; Ulysse Rousseau; Vital Boubours et Duret; E. Buchet; Ch. Jaeggé; A. Desaveines; Compagnie Continentale Caoutchouc et Gutta-Percha; Jules Richard; Société des Anciens Etablissements Audibert et Lavirotte; Durey-Sohy; Société des Applications Electriques; Francis Bosch; Paul Dubois; Leroy fils; Léon Rose; Société Européenne d'Automobiles; Ernest Lehut; E. Davis et Cie; H. Nègre; H. Gauchot; Louis Barnascone; René Heurtey; Joseph Planès; Saint frères; Société Française des Voitures Electriques Waverley; L. Delaloc; Gianoli et Lacoste; Bailleau; Petitjean Sevette; Edmond Dietz; Société des Chaudières et Voitures à vapeur (système Scotte); Société Ernst et Cie; Compagnie Française de Cycles et Automobiles (Onfray); P. Rossihol; A. Teste, Moret et Cie; Cambier; Léon Lefebvre; Cycles Clément; Grapholine Mfg Co. Ltd; Syndicat du Teuf-Teuf; L. Lagard; Etablissements Hutchinson; Compagnie Française des Moteurs à gaz et des Constructions mécaniques; Charles Schmidt et Cie; A. Richard et Cie; H. Maillard; Eugène Bouogne; Jules Guenet; Genty Société des Moteurs Garreau; Lathoud aîné; Rolland, Vinot et Deguinguand; Hanzer frères; J.-C. Howell Limited; David et Bourgeois; E. Hermet; L. de La Forest et Maus; C. Penelle; Rousseau et Cie; Michelin et Cie; l'Industrie Vélocipédique et Automobile; Georges Brion; Paul Lecreq; G. Cochot; E. Villeval et Cie; O. Englebert fils et Cie.

Motor vehicles have not yet been legalized at that popular English holiday resort, the Isle of Man, but it is only a question of a month or two. It is one of the old standing customs on the island that all new regulations shall be "proclaimed" from Tynwald Hill, and the act permitting motor vehicles to be run on the public roads of the island is to be duly proclaimed in July next. As the holiday season will then have commenced the proclamation is likely to be attended by a large concourse of people.

Even in the mountainous districts and the Tyrol the automobile movement is rapidly spreading, the Tyrol Automobile Club having just been formed at Innsbruck. It will be affiliated to the Austrian Automobile Club of Vienna.

The construction of motor-cycles and carriages is, it is reported, being taken up by the Victoria Fahradwerke Gesellschaft, (late Frankenburg & Otenstein), of Nuremberg, Germany.

New motor vehicle manufacturing concerns in France are La Compagnie des Automobiles et Moteurs Cote, at St. Dizier (Haute Marne), capital, \$65,000, to exploit the patents of M. C. Cote & Co., and establish works in that town, and at Neuilly, near Paris, Wehrlé & Co., capital, \$30,000.

MINOR MENTION.

The Canada Lewis Motor Vehicle Co., \$1,000,000 capital, is a recent New Jersey corporation, a branch of the Lewis Motor Vehicle Co., of Philadelphia.

The Automobile Truck Co., of New York City, is negotiating for the purchase of the old Gilbert Car Co.'s plant at Green Island, near Albany, N. Y.

W. L. Elliott, 1012 Telegraph avenue, Oakland, Cal., has obtained capital to back his motor vehicle enterprise, and is enlarging his factory and putting in new machinery.

The Judd-Comiskey Motor Vehicle Co., of New York City, was recently incorporated, to manufacture and deal in motors and vehicles, with a capital of \$100,000. The directors are Frank W. Comiskey, Archibald F. Comiskey, Amzi Camp and Frederick A. Camp, of New York City.

J. C. Turner, an architect of Augusta, Ga., has constructed a gasoline carriage weighing 800 pounds.

The Dovetail Co., Crawfordsville, Ind., are contemplating the manufacture of motor carriages.

The Owen H. Fay Livery Co., Chicago, Ill., have put the first electric cab for hire in the streets of that city.

The Rochester (N. Y.) Electric Vehicle Co. is on the tapis. It is a ramification of the Whitney-Widener-Elkins syndicate.

The Electric Carriage and Battery Co., Cleveland, O., and Philadelphia, Pa., has been incorporated at Dover, Del., with \$1,000,000 capital.

Studebaker Bros. Mfg. Co., South Bend, Ind., are building 100 cabs for the Electric Vehicle Co., New York, and will enlarge their factory.

The flat-tread, heavy pneumatics of the Diamond Rubber Co., Akron, O., are said to be giving good satisfaction on the New York electric cabs.

The Crouch Automobile Mfg. Co., Baltimore, Md., has leased property at the corner of North avenue and Oak street for the erection of a factory.

The New Haven Carriage Co., New Haven, Conn., recently shipped five electric carriages to the Paris branch of the Cleveland Machine Screw Co.

Stanley Bros., the Whitney Motor Wagon Co., and the Graham Equipment Co., have entered the international competition, to be held at Liverpool, England, on July 28.

The aldermen of Newton, Mass., have passed an ordinance limiting the speed of motor vehicles in the city to ten miles an hour, and providing for a fine of not to exceed \$20 for each offense.

The National Bicycle and Motor Co. was recently incorporated at Bridgeport, Conn., with a capital of \$2,500,000, to manufacture and sell all kinds of motor vehicles as well as bicycles.

Among new Maine corporations is the United States Motor Carriage Co., capital stock \$10,000; incorporators:—President, John E. Stevens; treasurer, John A. French, both of Andover, Me.

The National Transportation Co., of Boston, which is to run steam omnibuses in Winthrop and other suburbs of Boston, has applied for an exclusive license to run motor vehicles through Brookline.

General Greely, chief of the United States Signal Service, has ordered three electric vehicles from the Fischer Equipment Co., Chicago, Ill., to be used as telegraph and balloon wagons by the Signal Corps of the army. The order amounted to about \$8,000.

Dr. Truman J. Martin, Buffalo, N. Y., who is interested in establishing an electric vehicle service there as a branch of the Columbia Automobile Co., reports that he expects his company will have as many as twenty vehicles in use before fall. Broughams, wagonettes, surreys and delivery wagons will be employed, and a line connecting Buffalo with Niagara Falls is contemplated.

The Rhode Island Automobile Transit Co. has applied for a charter under Rhode Island laws, the applicants being John J. Bannigan, Julian A. Chase, Daniel McNeven, Edward L. Freeman, Jonathan Chase, William B. Bannigan, Frank Mossberg, Charles U. Polsey and Henry C. Luther. The charter gives the company the power to purchase, construct and maintain public vehicles, and operate the same on any public road in the State. It is to pay the usual license fee.

Motors Displace Horses at the Grand Central Station.

Geo. H. Daniels, general passenger agent of the New York Central and Hudson River Railroad, has decided to establish a system of electric cabs and carriages at the Grand Central station, New York City. A charging plant and general repair shop will be included in alterations soon to be made at the station. The cabs will be owned by the railroad company.

To Make Daimler Carriages Here.

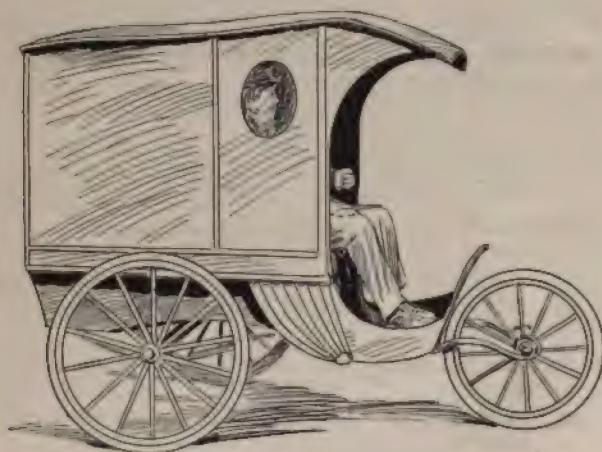
Arthur Kittson, treasurer of the Daimler Motor Co., Steinway, N. Y., P. A. B. Widener, W. L. Elkins, G. W. Elkins and others have secured a controlling interest in the Daimler Motor Co., having purchased \$210,000 out of the total of \$400,000 stock, and will organize a new company to manufacture gasoline vehicles propelled by Daimler motors.

The new company will have the exclusive United States license to use the Daimler vehicle motors, which will be manufactured by the Daimler Motor Co. at Steinway.

The plant will be greatly enlarged and Frederick Kuebler will be retained as general manager of the new company.

Duryea Light Delivery.

The Duryea Mfg. Co., Peoria, Ill., have completed their first delivery wagon far enough for trial. The cut herewith shows the general appearance of it.



This vehicle weighs about 800 pounds empty and will carry 600 pounds load. It has two speeds forward, and a reverse, and having the single steering wheel will turn very short when desired. It has their regular six H. P. triple-cylinder motor, without countershaft, and is especially fitted for suburban delivery. A more complete description was given in our issue of May 10th.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

Something About Steering Mechanism.

There is one feature of the motor carriage problem which from a mechanical standpoint seems to be lagging behind, and that is the steering mechanism.

From the time the first vehicle was seen on the road to the present day, the same bell cranks, connecting rods, uprights and handle-bars are in evidence. Of course, some of the newer carriages have some cushion springs or shock receivers added to the steering, but those additions merely complicate parts without doing any material good.

It is hardly necessary to point out to the driver of any of these carriages the objections to the present system of steering, but if the engineer in charge of designing this mechanism would take a two-hours' run over some bad country roads with a vehicle weighing somewhere about 2,000 pounds, he would readily see that improvement is much needed. The writer's arm was lame and sore for several days after a three-hours run over country roads. Of course, some one will say, that it was a poorly constructed machine or that something was wrong, but I have had the same result from all the different makes, no matter how driven, so long as the same steering mechanism was used. Over good asphalt pavements one can of course ride all day with practically no strain on the hand or arm, and even so, an almost perfect alignment of front wheels is necessary to avoid a tendency to run to one side. As soon as bad pavements or country roads are struck, the muscles of the arm will be in tension, and the effect of all the little jars and shocks from every little stone or unevenness in the road, transmitted to the arm, is far from pleasant. On very heavy trucks, where handwheel, pinion and rack are used, and slow speed is taken, the direct jar or shock is practically nil, but that steering device is out of the question for light and quick-moving bodies. From a mechanical standpoint, there seems to be something decidedly wrong, when it is expected to run a heavy delivery wagon with all the traction resistance of the front wheels thrown on one hand, over sandy or rough roads.

The much advertised phrase: "A lady or child can easily manage it," is not quite up to the facts, outside of the good roads of a large city. It is strange that power is not made to do the work, especially where a constant pressure is used; for instance, the principle of the reversing gear on a locomotive could be brought into play. I refer to the oil locking cylinder, operated by pressure on the piston; a very simple arrangement, an opening of a valve or two constituting all the labor involved.

In the electrical field several makers are contemplating an improvement, by which a series of magnetic contact blocks will be operated by switch or rheostat, power being taken from storage battery.

On a gasoline or vapor motor the solution would not be quite so simple. By complicating the parts somewhat an air compressor could probably be devised, connected by eccentric from one of the axles, but whether such an arrangement could be made substantial and still light enough is a question.

INTERESTED.

He—"Did you ever ride in a horseless carriage?"

She—"Yes; once."

He—"How did you like it?"

She—"Not at all. The fellow had to use both hands to work the levers."—*Chicago News.*

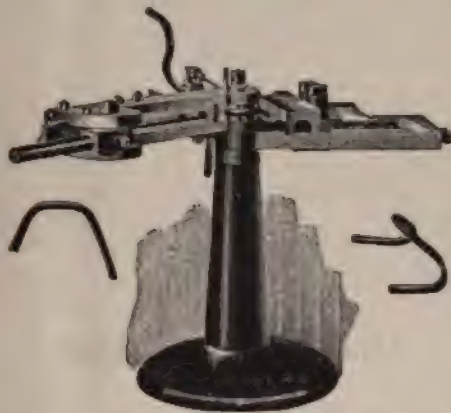
MACHINERY and TOOLS for motor vehicle builders

Readers using information from this department are requested to give credit

Tube Bending Machine.

This machine, made by the Bridgeport Tubing Co., Bridgeport, Conn., is designed for bending tubing from $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. diameter, from 14 to 22 gauge, *without heating or filling the tube*, bending accurately to the form desired, and maintaining with the slightest possible variation its circular cross section after the operation.

The surface of the tube on the inside of the curve is free from imperfections, needing no dressing by the aid of files, which is so detrimental to the strength of the tube, for the outer surface is not displaced or broken in any way but left as smooth as the original tube.



This machine is especially adapted for seamless tubes for gear frames, or side bars for motor vehicles, and will bend offsets, both on the same plane or at any angle, or U bends of any desired length, and will also handle brass and copper tubes where it is essential to have full sized openings and smooth for the free flow of liquids; in fact, anything where fine work is needed.

The accuracy of the forms is very noticeable, and it is said they might be called templets for their precision.

The bending is done on grooved rolls mounted on a spindle projecting from the top of the column. This roll is engaged by a sliding table correspondingly grooved, which in connection with the roll grasps the full circumference of the tube. In this groove lies a mandrel attached to an adjustable rod, which is anchored in the rear of the machine. On this rod is an adjustable gauge on which the end of the tube rests, that all bends may be of uniform length.

The grooved roll is doweled to a yoke from which extends the lever to actuate the machine.

Between these yokes is a gripping device operating as follows:

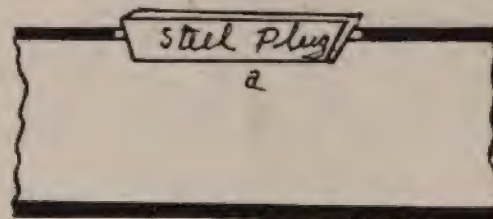
The tube is placed on the mandrel to the stop gauge and the sliding table forced up to the rear of the yokes. The first forward motion of the hand lever acts on a compound lever which forces the grip against the bending roll, firmly clamping the tube. The continued movement of the lever rotates the roll, drawing the tube from the mandrel, while the sliding table, starting with the yokes, supports the tube to the end of the stroke, which is regulated by a stop dog.

By the changes of the rolls and position of the gauges, bends may be made of almost endless variety.

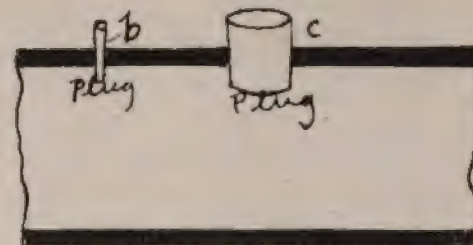
A tool which is of use in the manufacture of gasoline motors is the Bickford Radial Drill. It drills all the holes in the cylinders, heads and bases of large double-cylinder motors, inasmuch as the drill head can be swivelled and the drill directed at any desired angle.

Motor Vehicle Repair Shop.

Fractures in tubing of motor vehicles can be repaired by patching, but many times a neater job is accomplished by plugging. Suppose there is a longitudinal fracture in the tube. Rather than patch, cut out the metal around the fracture and put in a steel wedge shaped plug (2) Fig. 1. The plug should taper on the four sides and the opening in the tube be filled in to correspond. As this plug is to be welded in, that part of the tube becomes as strong as any other part. After fitting the plug heat it red to a welding temperature and drive it into the



1: Section of Tube



2: Section of Tube

previously heated tube. Use borax in liberal quantities and be ready to hammer lightly in closing up. Holes may be closed in tubing on the same principle by using tapering round pieces like (b) and (c) in 2. After assuring a good weld, file the projections to a level with the tube, braze over, smooth and enamel and no trace of the repair will be seen.

OUR FOREIGN EXCHANGES.

The Headland Electric Vehicle Motor.

In this motor the distinguishing feature is that both the armature and the frame carrying the field magnets revolve at the same speed in opposite directions; both also act as drivers. This is effected by hanging two motors on the same shaft or axis; the center of each motor is connected mechanically to the field or casing surrounding the armature of the other. The armature is fixed on a shaft, which passes through a hollow shaft upon which the armature of the other motor is fixed, and the field magnet casing around this latter is by a cylindrical open-worked framing mechanically connected to the armature of the first motor; the framing surrounding the magnet casing of the other motor.

The combination is shown on the accompanying drawing, which is a longitudinal section of one form of motor constructed according to this principle, and in which the rotating parts balance each other's centrifugal forces at all speeds. The armature, *a*, of one motor is fixed on a shaft, *b*, which passes through a hollow shaft or sleeve, *c*, upon which the armature, *a*¹, of the other motor is keyed, and the field magnet casing, *d*¹, around this latter is keyed to the shaft, *b*. Upon the end of the shaft, *b*, is a sprocket wheel, *e*¹, for transmitting the power, and upon the outer end of the sleeve, *c*, or hollow shaft is a spur wheel, *f*, which gears with a spur wheel, *g*, upon another shaft, *h*, that carries a sprocket wheel, *e*, for power transmission. Both these sprocket wheels will thus be rotated in the same direction, and such an arrangement is suitable for driving a moto-car.

One end part, *d*₂, of the casing has to be made in two halves bolted together as shown. The casings, *d*, *d*_x, and *d*₁, *d*₂, may be open-worked, but are by preference closed dustproof. For driving by spur wheel gearing instead of by sprocket wheels and chains, a spur wheel may be fitted on one end of the shaft and another spur wheel on a sleeve at the other end, one such wheel being made to gear with an outside spur wheel and the other with an inside spur wheel. For driving in opposite directions and in the same axis two screw propellers, the one with right and the other with left-handed pitch, without employing wheel gearing, the wheels, *e*¹, *f*, *g*, and *e* are omitted, and one propeller is fitted on the prolonged end of the shaft, *b*, and the other propeller on the prolonged end of the sleeve, *c*.

By a reverse arrangement the armatures may form the outer parts and the field magnets the inner.

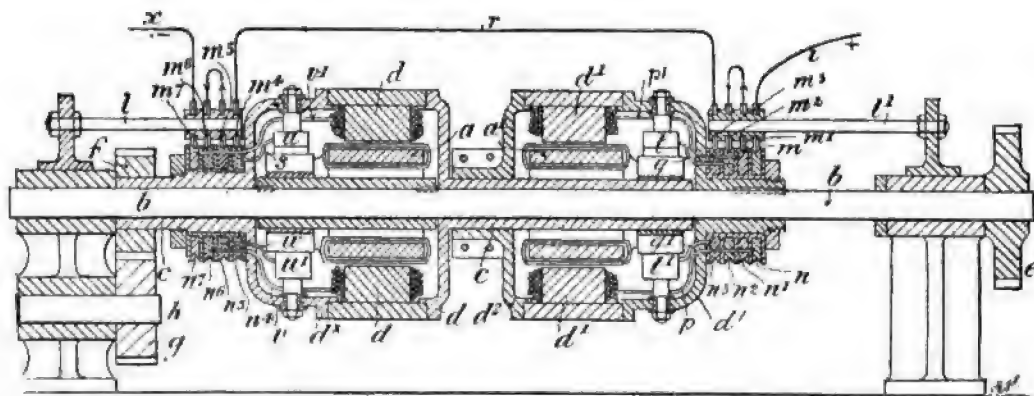
The current may be supplied in the manner indicated. The wire, *i*, leads from the battery to the outer end of one motor, and the wire, *x*, from the outer end of the other motor back to the battery. On the studs, *l* and *l*¹, are carried four brushes, *m*, *m*¹, *m*², *m*³, and *m*⁴, *m*⁵, *m*⁶, *m*⁷, which engage with rings, *n*, *n*¹, *n*², *n*³, and *n*⁴, *n*⁵, *n*⁶, *n*⁷, that rotate with the motors. These brushes are insulated from the studs and from each other. Other brushes, *u* and *t*, and *u*¹, *t*¹, are fixed to but insulated from the interior of the field magnet casings, *d*_x and *d*₁, and connected by insulated wires to the various parts. The current thus runs from battery wire, *i*, into brush, *m*, collecting ring, *n*, wire, *p*, field magnets, *d*₁, wire, *p*¹, ring, *n*¹, brush, *m*¹, brush, *m*², ring, *n*², wire, *q*, brush, *t*, brush, *t*¹, wire, *q*¹, ring, *n*³, brush, *m*³, wire, *r*¹, brush, *m*⁴, ring, *n*⁴, wire, *s*, brush, *u*, brush, *u*¹, wire, *w*, ring, *n*⁵, brush, *m*⁵, brush, *m*⁶, ring, *n*⁶, wire, *v*, field magnet, *d*, wire, *v*¹, ring, *n*⁷, brush, *m*⁷, wire, *x*, to battery.

The two motors are connected in series. But by changing the connection wires to the brushes of the collecting rings two armatures may be put in series and two fields in parallel, or the two armatures in parallel and the two fields in series, and the sequence of connections to armature and field magnets may be either field magnet, armature, field magnet armature, or field magnet armature, armature, field magnet. By this means it is possible to reverse the current and the rotary motion of the motor. By the arrangement described the rotating parts may be made to balance their centrifugal forces at all speeds.

As applied to motor vehicles it is claimed that with this arrangement no differential gear is needed to enable the vehicle to turn round a corner, inasmuch as the armature of one motor and the field magnets of the other motor automatically slow down together to the required speed, while allowing the other armature and field magnets to run together at their full or required speed.—*Automotor*.

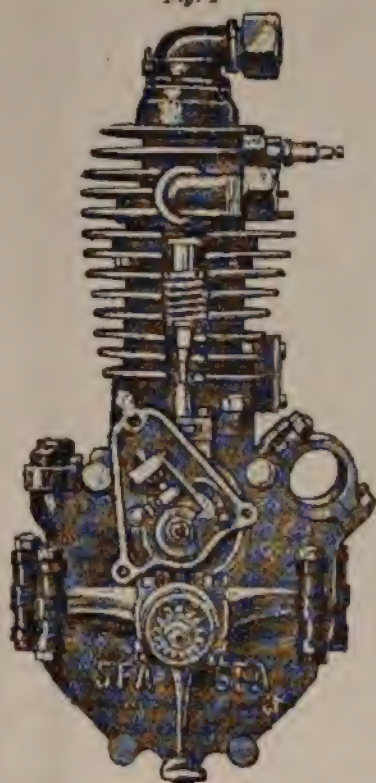
The Gaillardet Motor.

This single cylinder vertical motor, for tricycles and voitures, develops two and three-quarters H.P. The crank shaft operates a disk forming the fly wheel, upon the shaft of which is a pinion. Above the cylinder is the explosion chamber containing the inlet and exhaust valves, the latter being



THE HEADLAND ELECTRIC MOTOR.

Fig. 1

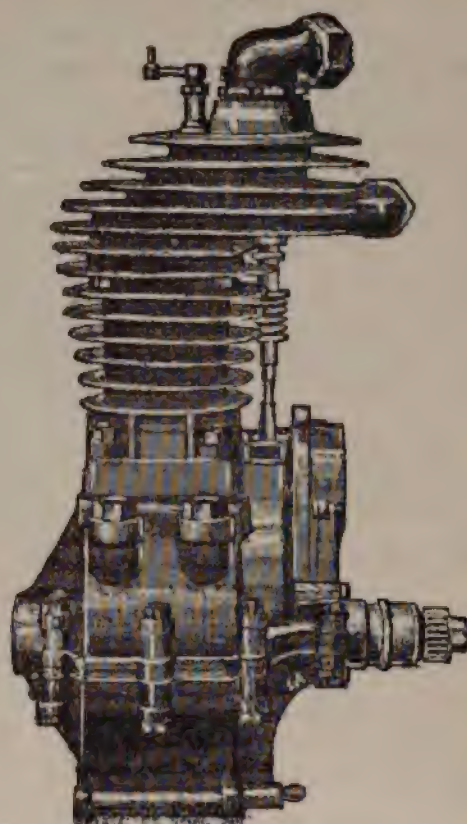


SIDE VIEW, GAILLARDET MOTOR.

operated by a cam which turns half as fast as the motor shaft and the axis of which carries the electric apparatus. Owing to the fact that the radiating ribs extend to the very top of the explosion chamber the motor has an appearance of unstable equilibrium.

All the mechanism is enclosed in a self-oiling crank case.

Fig. 2



FACE VIEW, GAILLARDET MOTOR.

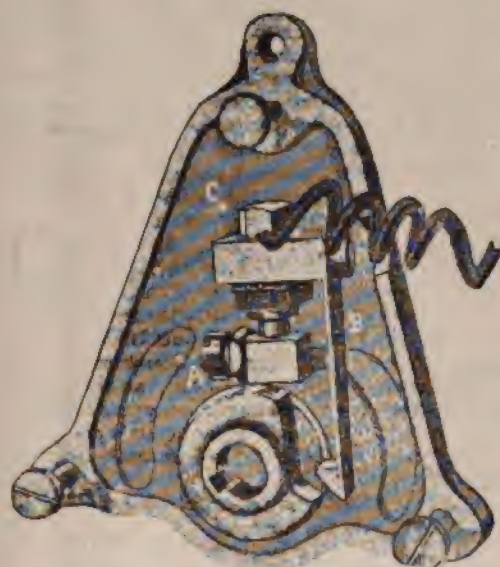
A storage battery supplies current to a transformer consisting of a bunch of wires dipped in paraffine with the object of obtaining a very hot spark through the contact or vibrator.

The vibrator B (Fig. 3) is a flat piece of steel which allows

Fig. 4



Fig. 5



DETAILS OF GAILLARDET MOTOR.

Fig. 3. Location of Buzzer.

Fig. 4. Ignition Plug.

Fig. 5. Carbureter.

the current to pass only when the hammer falls into the notch in the ignition cam controlled by the motor. It is regulated by the screw A, on which lies a platinum contact point set in the vibrator B. The ignition plug (Fig. 4) consists of an insulated part of porcelain tightly fixed in a metallic casing.

The carbureter (Fig. 5) is composed of a brass box of a capacity of three litres of gasoline at 700, and filled through the tube A, so placed as to indicate the maximum level. An air inlet B is so devised that its inner orifice can be adjusted to the level of the liquid; being lowered and raised as required. The pipe C, supported by a float, reaches the level of the fluid. The valve D regulates both the vapor and the air in one of its extreme positions, shutting off the vapor entirely and admitting only air, in the opposite extreme shutting off the air entirely and admitting only vapor.

The valve E regulates the supply of explosive mixture. To overcome the refrigerative efforts of rapid evaporation a coil tube F, placed in the bottom of the carbureter, conducts a portion of the hot gases of the exhaust. The vent G empties the carbureter when desired.

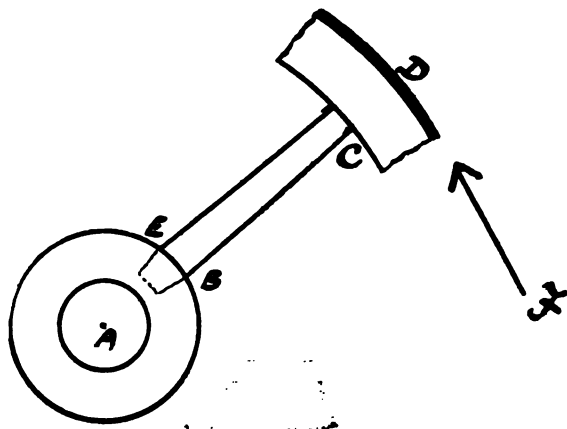
Stresses in Driving Wheels.

BY H. E. WIMPERIS, WH. SC.

The very great importance of accurately knowing the stresses that occur in driving-wheels is evident to all, and is especially brought to the front by the unhappy accident that occurred to a Daimler autocar at Harrow towards the end of February of this year.

Engineers do not build structures so as to be just able to withstand the stresses to which they know the structures will be subjected, but always allow for occasional and far greater stresses than those that occur in ordinary working. They do not know exactly what will be the maximum stress to which their driving-wheels will be subjected, and so they use what is called a "factor of safety"—often referred to (owing to the reasons given above) by Professor Perry as a "factor of ignorance." These factors usually vary between two and ten, and the average value may be put as something between four and six. If it were worth the designer's while he might laboriously enter into every little detail of possible stress and provide against each, but such difficulties as flaws in material, non-axial roads, blows, etc., can only be reasonably provided for by use of a factor of safety.

Considering the case of the design of driving-wheels, we must first decide on either wood or iron as a material for construction, or what comes to pretty much the same thing, be-



tween compression spokes or tension spokes. As this article is written in view of the Harrow accident, wooden wheels will be mainly considered.

Fig. 1 is a line diagram indicating the relative positions of nave, spoke, felloe, and tire, and calling the radius of the nave r , the length of spoke between nave and felloe l , the depth of felloe and tire d , and the sectional area of the spoke at any part s , then $AB = r$, $BC = l$, and $CD = d$. We will also call the force acting on the tire and tending to twist the hub F , and for convenience we will take F to act at the outer circumference of the wheel; also let there be n spokes in the wheel. The spoke, BC , is rigidly fixed into the nave, and this being so, we may consider each spoke to be a beam fixed at one end and

loaded with a force $\frac{F}{n}$ at the other; we then know that the maximum bending moment occurs at B , and is equal to the product of the length, BC , into $\frac{F}{n}$, that is—

$$\text{Bending moment} = \frac{F \times l}{n}$$

$$\text{or more accurately} = \frac{F \times (l + d)}{n}$$

Also the shearing force is constant and is everywhere in each spoke equal to F divided by n , and the shearing stress $\frac{F}{n \cdot s}$.

It has been assumed here that every spoke takes its proper share of the tangential effort, and this is one of the cases in which the "factor of safety" makes itself useful; for if some of the spokes are badly fitted an extra load will be thrown on to the rest. In order to get some idea of what the stresses are in actual figures, take the case of a steam omnibus, in which the diameter of the driving-wheels = four feet, we also have $l =$ fourteen inches, $r =$ six inches, and $d =$ four inches.

To get a suitable value for F we have the total loaded weight of the vehicle to be about seven tons, and if we wish the vehicle to be able to be driven up an incline of (say) one to ten, the tangential force that must be exerted by the two driving-wheels will be about 2,000 lbs.; allowing for road resistance as well this gives 1,000 per driving-wheel, so that $F = 1,000$ lbs. The number of spokes used in the particular type chosen is sixteen, so that $n =$ sixteen. Then the maximum bending moment occurs at BE , and its value is:

$$B.M. = F \times \frac{l + d}{n} = 1,000 + \frac{14 + 4}{16} = 1,000 \times \frac{18}{16} \text{ in.-lbs.}$$

$$\therefore B.M. = 1,125 \text{ in.-lbs.}$$

The shearing force is everywhere $\frac{F}{n} = \frac{1,000}{16}$.

$$\therefore \text{Shearing force} = 62\frac{1}{2} \text{ lbs.}$$

Now, the breaking strength in shear of oak is not less than one ton per square inch, and taking it, as a lower limit, as being one ton per square inch, we have the minimum allowable

$$\text{sectional area of spoke} = \frac{62\frac{1}{2}}{2,240} \text{ square inches} = 0.28; \text{ inserting}$$

a factor of safety of five we obtain minimum permissible area of spoke = 1.4 square inches. Taking BE in Fig. 1 as being 1.5 inches, we should have (for rectangular section) the other dimension of the spoke parallel to the axis of wheel as only 0.94 inch, in order to safely resist shearing action, and it is almost needless to add that this dimension will certainly exceed one inch, and thus the wheel will not fail by shearing action at BE ; generally the spokes taper from B to C , so that

there is greater chance of failure by shear occurring at C than at B, and care must be taken to see that the shearing stress is not too great at this point.

The maximum bending moment was found to occur at BE, and to be 1,125 inch-pounds; again using five as a factor of safety, the dimension perpendicular to BE (again assuming rectangular section) can be found; call it t , and taking breaking stress for compression to be 10,000 lbs. per square inch, we have (z being the strength modulus):

$$\frac{10,000}{5} = \frac{1,125}{s} \text{ where } s = \frac{1}{6} t \times (1.5)^2 = \frac{3}{8} t.$$

$$\therefore s = \frac{3}{8} t = \frac{1,125}{2,000}$$

$$\therefore t = \frac{9,000}{6,000} = 1.5 \text{ inch.}$$

This means that the thickness t of the spoke parallel to the axis of the wheel must not be less than one and one-half inches, and if this thickness there would be no risk of failure either by too great a bending moment or by shear. Lastly, we have to consider the compression introduced both by the load on the wheel and that produced by the binding action of the tire.

One spoke alone in each wheel could support its wheel's share of the load if the spoke were only one inch square, and little need be said on this point, as the best plans for providing against direct loads were known long before the advent of moto-cars. This remark also applies to the binding action of the tire; in connection with the subject of actual compression of the spokes, we must also remember that they are struts subjected to bending as well, and when these two different stresses act together their results are rather similar to the mounting up of "compound interest."

With reference to the tapering of the spokes, this should be slight, and for uniform strength Unwin gives (p. 70 of Part I. of "Strength of Materials") a conical tapering, so the diameter near the felloe is about two-thirds of the diameter near the nave.

The great necessity for a large factor of safety is brought out by this quotation from Professor Perry's "Applied Mechanics": "An endlong load (on a bar of steel one inch in diameter and forty-eight inches long), only sufficient of itself to produce a stress of 1,900 lbs. per square inch, and a bending moment which by itself would only produce a stress of 816 lbs. per square inch, if both act together produce a stress of 23,190 lbs. per square inch."

This shows very vividly how in exceptional cases the double effect may mount up, and it is against these exceptional cases that we must be on our guard.—*The Automotor.*

The Value of Electric Brakes as Recuperating Devices for Motor Vehicles.

In reply to Mr. Henry, T. B. Booth says in a recent issue of the *Electrical World and Electrical Engineer*:

In regard to the exception taken by Mr. Henry in the issue of April 9 to the figures submitted by me under the above caption, it seems wholly a misconception of the different conditions pertaining in the case of motor vehicles and street cars.

A draw bar pull of 18 pounds per ton is, I believe, not far from the generally accepted figure used in street car practice under good roadbed conditions, and this would permit, so far as the physical possibility is concerned, of doing what Mr. Henry mentions respecting the 15-ton car on a six per cent. grade. But this is a case of iron wheels on steel rails,

Quite different is the road vehicle with its rubber tires on all kinds of pavement good, bad, and frequently none at all, and it is only natural that a much greater level drawbar pull should be required; 50 pounds per ton, the figure assumed for a 2,000-lb. pneumatic tired carriage, is sanctioned by actual measurement, being, if anything, a low average figure, for it was obtained upon a hard macadam pavement. Rankine's formula for steel rails and iron wheels has no place here, and it can readily be seen how the ratio of the power required on a ten per cent. grade to the power on a level may be one-third of what it is with the street cars, and how recuperating brakes upon the two vehicles would differ in the percentage of power which could be returned.

It is to be noted that in the case of the motor carriage, not only is this device at a disadvantage as compared with the street car, through the large portion of the gravity component which is balanced by the frictional resistance of the tires in descending grades, but the power must be stored in batteries under conditions which give but little more than sixty-five per cent. efficiency.

COMMUNICATIONS.

Relative Size of Compression Space and that of Gas.

WATERTOWN, CONN., May 8, 1899.

Editor HORSELESS AGE:

I have recently constructed a small gasoline engine of about $1\frac{1}{2}$ H.P., weighing 150 pounds. In the descriptions of various engines contained in your valuable paper, and in such books on the subject as I have seen, I have been unable to find anything definite in regard to the proportion the compression space bears to the space occupied by the gas when the piston is at the end of the suction stroke; that is, what proportion in the number of cubic inches does the gas, when compressed, bear to the number of cubic inches before it is compressed? I first constructed my engine to compress the gas into one-fifth its previous volume. It gave great power at 800 revolutions, but at 300 it took too much power to compress with my 15 in., 60 lb. fly wheel, so I was compelled to reduce to about one-third. I would think it a great favor if you could give me any information in regard to the practice now in general use in small motors of light weight. Respectfully yours,

JAMES B. WOOLSON.

A Pleased Customer.

NEW YORK, May 26, 1899.

Editor HORSELESS AGE:

I am a subscriber to your paper, THE HORSELESS AGE, in which I take a great deal of pleasure. I own a gasoline motor carriage, which I came into possession of last January and have made quite a number of long trips in it.

On Saturday last, May 20, I took a trip from New York to Philadelphia and return, making the run to Philadelphia in about eight hours. The trip was quite successful, with the exception of a slight delay on the return, which was caused by the water tank springing a leak, due not to fault in the construction of the carriage, but to a bolt dropping on the chain, which passes the water tank and punctured it. The trouble was easily remedied, however, and the trip resumed. New York being reached Sunday afternoon.

If you so desire, I will be pleased to give you fuller details of the trip. I am yours very truly,

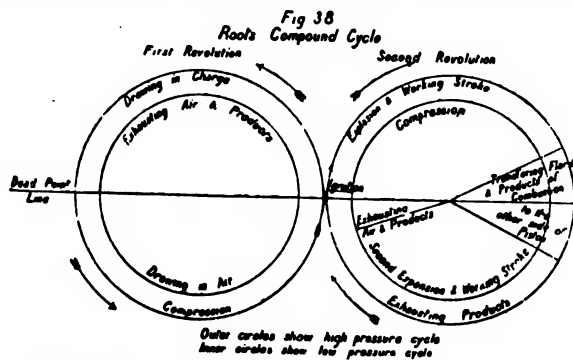
F. A. LA ROCHE.

The Cycles of Gas and Oil Engines.

BY MR. JAMES D. ROOTS.

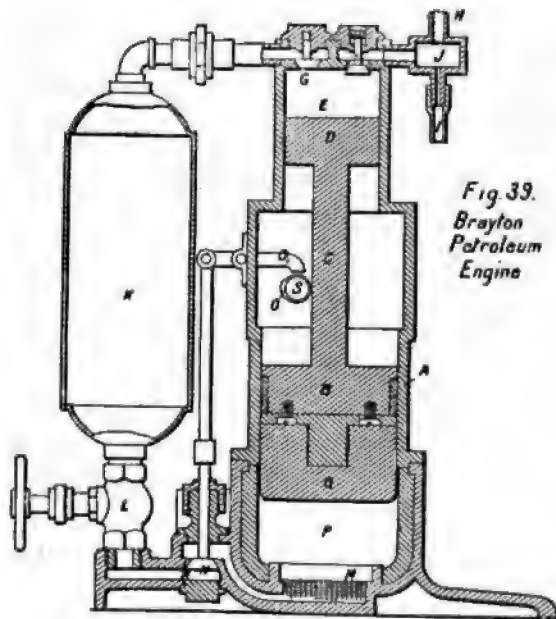
No. XI.

All the types and cycles hitherto considered were explosive engines, i. e., ignition of the whole working charge in the combustion chamber or clearance space of the engine is effected at once, and in such a fraction of a second as to be relatively almost instantaneous, although extreme dilution of the fuel by either products or air will render ignition slower. In this class, however, the working charge is ignited as it begins to enter the combustion chamber or clearance space, and the combustion flame goes on during the whole time of delivery of and from the port of admission of the mixture.



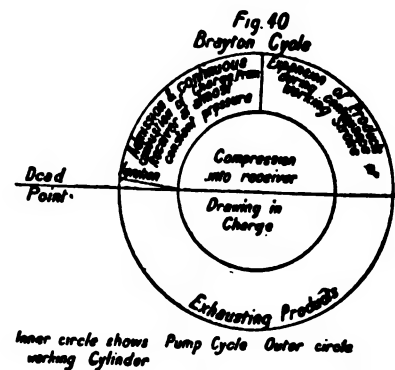
The Brayton petroleum engine, one of the earliest and best known engines of this class and type, is selected as the first representative of the class. The patent was taken out in this country February 10, 1872, No. 432, Gas Engines, by Brayton of Boston, Massachusetts, U. S.

Fig. 39 is a vertical section of the Brayton engine from the patent. A is the working cylinder provided with a water-jacket—not shown—B is the working piston connected by the



rod C to the pump piston D; E is the pump cylinder; F is the pump admission valve, and G the delivery valve. H is the inlet pipe for air, and I the supply pipe for gas or petroleum vapor from a carbureter, both of which are fitted to the mixing

chamber J; K is the receiver or pressure chamber, into which the fuel and air are pumped and retained under pressure; L is the screw valve which controls the admission of the mixture to the cylinder; M is the burner placed at the bottom of the working cylinder; it consists of a number of layers of wire gauze; N is a second valve controlling the admission of the mixture, operated by the cam O, and returned by a spring. The cam O, by means of the lever O₁, opens the valve N during the working stroke of the engine. P is the combustion chamber; Q is a mass of non-conductive material* (the specification says soapstone) to protect the piston from the high temperature of the combustion chamber; R is a "V-shaped channel" cut into the valve seating of the valve N to form a by-pass for the mixture, to maintain an ignition flame at the burner M during the non-working or exhausting strokes; S is the crank shaft; the crank and connecting rod are not shown. The exhaust valve does not show on this section, but it is opened by a cam on the crank shaft in the usual manner. Either gas or the vapor of petroleum spirit may be used as fuel, and the inlet pipes are fitted with screw valves to adjust the respective quantities of fuel and air that may be required. If petroleum be used the petroleum spirit naphtha is dropped upon a sponge through which air is drawn by the pump to vaporize it. Of ordinary gas it is stated that one part to twelve of air forms the best proportion for complete combustion.

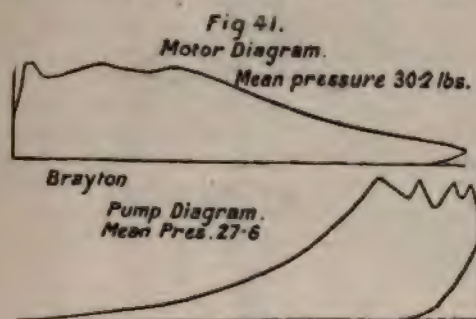


The gauze M serves the double purpose of a burner and to prevent the flame passing back to the receiver K. To start the engine, the fly-wheel is turned by hand and the pump piston D draws in its mixture of gas or petroleum vapor and air through the chamber J and the valve F into the cylinder E. The return or upward stroke compresses it through the delivery valve G into the receiver K, to a pressure—a gauge is fitted to the receiver—of at least 60 lbs. to the square inch. The screw valve L is opened by hand, the mixture flows through the by-pass channel R to the gauze diaphragm burner M, and a light is applied to it through the exhaust port. The working piston is placed in its lowest position, the valve N is opened by the cam O and lever O₁, and the mixture for the working stroke flows through to the gauze burner, where it is ignited by the flame, and expanding in burning drives the piston upward. The mixture continues to flow through and burn at the burner through the greater part of the stroke. On the return, or downstroke commencing, the valve N is already closed, the exhaust valve is opened, and the products of combustion are expelled by the piston from the cylinder. At the next upward stroke the cycle recommences. Although Brayton does not specify a cut off period in the original

* Such a provision appears in numerous specifications, but is probably of very little use.

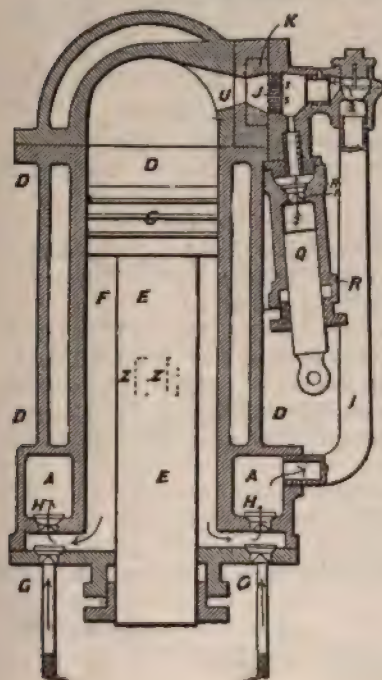
patent, in most other specifications of engines upon this cycle it was usual to cut off the charge at about half the stroke, and Brayton subsequently did so in the engine cycle, but I do not think it is possible to make an engine of this class that will excel in general convenience and reliability some of the types of engines of Class 2—a good compound, for instance—or even in economy if the only actual and commercial test be applied, that of continuous daily and all work.

It is upon this system that the Diesel engine, which has recently been described and illustrated in these pages, is constructed. The Diesel engine, patented A.D. 1892 in this country, has been described by the inventor as "novel in principle." On reference to the table, Class 3, Type 10, it will



be found that there are a considerable number working upon the same principle, namely, continuous combustion, and the inventor possibly made this claim in ignorance of the literature of the subject. Regarding it from the academic and not from the patentable point of view, for the latter does not lie within my province here, there is certainly nothing new in the engine beyond the very high compression employed, and

Fig 42
Williams and Baron



this is decidedly original. As far as I am aware, no English engineer had contemplated the use of so high a compression. But such a high compression will necessarily have certain disadvantages to possibly compensate for the advantages. Durability must be taken into consideration as well as economy. Nor for the relative sizes of cylinders or cubic capacity of piston sweep of two engines, the Diesel and an ordinarily constructed Otto, with an ordinary compression of, say, seventy-five pounds, would a Diesel engine be any more powerful. It is only the exceedingly high compression that would render an engine of class three a competitor with class two.

The engine described in the patent specification of Williams and Baron, No. 2, of 1879, has been selected as the second representative of this class. Fig. 42 is a section through the cylinder and fuel pump of this engine. A is the reservoir or chamber into which air is compressed and stored under pressure, D is the water jacketed cylinder, B is the piston having the trunk extension E of less diameter, within which is attached the connecting rod. Surrounding the trunk E is the annular space F, into which, by the movement of the piston B in the cylinder, air is drawn by the upstroke and delivered by the downstroke to the pressure chamber or reservoir A. G G are the valves by which the air is drawn into the space F, and H H are the air delivery valves to the chamber A. I is the pipe which conveys the air under pressure to the other end of the cylinder through the valve J, and the perforations S S in the grating J. K is a slide valve controlling the port U exhibited in this country, which engine was also otherwise modified.

The pistons of the pump and working cylinder were placed above and attached to opposite ends of a rocking beam, but this mechanical re-arrangement did not affect the cycle.

Fig. 40 is a diagram showing the Brayton cycle of operations. Fig. 41 is the working cylinder and pump indicator diagrams taken from a Brayton engine made in this country by Messrs. Simon, of Nottingham. This firm ultimately made this Brayton engine to run with gas instead of petroleum spirit, and attached a small boiler to the cover of the working cylinder. The exhaust products passed through a coil in the boiler and raised steam, which was used in the working cylinder. Any benefit obtained by the steam pressure would be more than counterbalanced by the cooling of the flame by the steam, and the consequent incomplete combustion.

In many specifications describing this class and type a regenerator is proposed to be used. In Siemens' patents for continuous combustion engines a regenerator is usually described. With regard to the valve of the regenerator, theoretically there ought to be a considerable benefit from its use, and one would certainly expect a well arranged regenerator that without throttling saved heat, would effect some economy of fuel; but it is significant that the only one of these engines—the Brayton—which had any commercial success was constructed without one, and it is doubtful whether any benefit will be found in practice from the use of one.

Great things have been expected of continuous combustion engines, owing to their theoretical perfection of leading into the combustion space, it also controls the ignition. R is a gas pump, Q its piston, which delivers gas through its valve R1 to the perforations S S under a pressure greater than that of the air. Z Z are the exhaust ports; uncovered by the piston near the end of the stroke, and also controlled by a slide—not shown—which latter would appear to be a wholly unnecessary complication.

The upward movement of the piston B in the cylinder D

draws air into the annular space F through the valves G G; the downstroke of the piston delivers this air through the valves H H to the annular chamber A, where it is stored under pressure. The air from the chamber A passes by the pipe I through the valve J, and the perforations S S in the grating J, controlled by the slide valve K, to the upper or combustion side of the cylinder. This delivery of air takes place towards the latter part of the upward stroke of the piston, by which it is further compressed. The higher pressure in D then closes the valve J, and at or near the dead point of the piston B and highest compression the gas is delivered by the piston Q in the pump R, through the valve R, and through the perforations S S in the grating J. On issuing from the perforations the gas is ignited by a flame in the slide valve K. The piston commences its down or outstroke, meanwhile the gas is continuously delivered through the perforations S S. At three-fourths of the stroke the gas is cut off, and the combustion products expand until the piston near the end of its working stroke uncovers the exhaust ports Z Z. More of the products are swept through the ports Z Z until they are again covered, by means of a flushing or scavenging quantity of air, which is permitted to pass through the valve K from the pressure chamber A. The piston then continues its upstroke, and the cycle re-commences.

"The engine may produce its own supply of compressed air, or the compressed air may be supplied by an independent pump." To start the engine, "the air may be supplied from a receiver, where the air is stored under pressure."

The points of resemblance in the Diesel engine to this engine are manifest.

Neither the engines nor specifications describing engines having continuous combustion, are sufficiently numerous at present for the same division as has been made in class two, but almost all the engines of the different types and divisions of class two might also have applied to them the continuous combustion of class three instead of explosion, and the majority might have this change of system effected with but very little change in mechanical construction. Generally an additional pump would be required for the delivery of the fuel under pressure. For instance, Williams and Baron's engine, except for the substitution of continuous combustion for explosion, is similar in cycle to type four, class two, while in the same way Brayton's engine, as at first made, and also as subsequently made, is similar in cycle, with the same exception, to type three, class two.

I have been sometimes somewhat doubtful if it would not have been better to have numbered the first type of class two in the table (q. v.) as type one of that class, thus making type nine type seven, and to have omitted number ten, leaving class three for future division in the same way and into the same types as class two is divided, when the engines become more numerous, as no doubt they will do.

But—thought, idea, and even expression relating to the cycles of the internal combustion engine, especially in relation to one another, were chaotic, and the need for classification was crying.

Lowers the Kilometre Record.

M. Jenatzy, whose odd shaped electric racing machine was illustrated in our issue of May 3, has succeeded in lowering the kilometre record of Count Chasseloup Laubat, his rival in the struggle for neck-breaking honors. He has succeeded in making the kilometre in forty-seven and four-fifths seconds with a standing start and in thirty-four seconds with a flying start. The last-named feat indicates a rate of speed of about sixty-three miles an hour. The racing machine was towed to its destination and back again.

Foster's Patent Reversible Propeller.

The accompanying drawing gives a very clear idea of a reversible propeller shaft, invented and patented by Chas. W. Foster, a well-known marine engineer of New Haven, Conn., and now in successful use on more than 150 launches and business boats. In this drawing



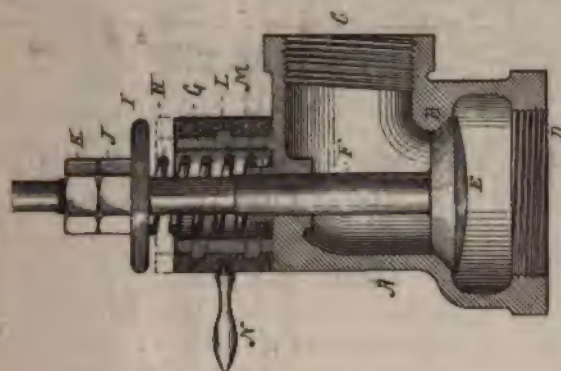
- A represents the Tobin Bronze Shaft.
 - B represents the Brass Thrust Tube.
 - C represents the Stern Tube, which passes through dead wood.
 - D represents the Stern Bearing.
 - E represents the Screw Clamp Collar on Stern Tube.
 - F represents the Cast Iron Thrust Chair.
 - G represents the Reversing Lever.
 - H represents the Packing Box on Thrust Tube.
 - I represents the Packing Box on Stern Tube.
 - JJ represents the two sets of Steel Thrust Balls.
 - KK represents the two Clamp Thrust Collars.
- When ordering this propeller only four measurements need be given:
- 1st. The size of propeller wanted.
 - 2nd. Length of shaft as designated by dotted lines from A to D.
 - 3rd. Location of thrust chair as shown by dotted lines from F to D.
 - 4th. Length of stern tube, as shown by dotted lines from E to D, which represent the distance through the dead wood and the stern post.

MOTOR VEHICLE PATENTS

of the world

No. 625,360—Valve—Albert R. Shattuck, New York, N. Y. Application filed June 9, 1898.

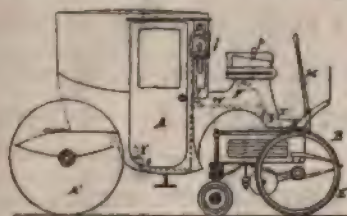
This invention consists in a puppet-valve having a stem which passes through a cylindrical threaded portion of the valve-case and is also encircled by a spring, by means of



which the valve is held to its seat. Surrounding this cylindrical threaded portion of the case is a threaded sleeve or nut, which on being rotated is raised or lowered, as the case may be, to vary the distance between its upper edge and a washer or projection on the valve-stem. In this way the throw or lift of the valve is regulated with accuracy.

625,953—Electric Device for Propelling and Controlling Vehicles—Rudolph M. Hunter, Philadelphia, Pa. Filed March 29, 1899. Serial No. 710,875. (No model.)

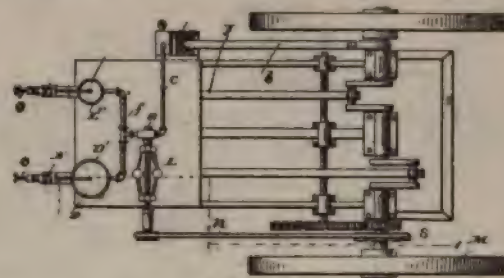
Claim.—In an electrically-propelled vehicle the combination of the body portion having a pair of rear wheels, with an electromotive mechanism consisting of a battery-box spring-supported on a pair of driving-wheels and pivoted to the front of the vehicle-body portion, a battery in and movable



with the box, a separate electric motor for rotating each of the driving-wheels, electric-circuits for supplying current from the battery to the motors, a controller for simultaneously controlling the speed of both motors adapted to be operated from the vehicle-body, one or more steering-wheels also supporting the battery-box and independent of the vehicle body, and means also extending to the vehicle-body for adjusting the steering-wheels and rendering either motor non-propelling whereby the battery-box motors and driving-wheels may be caused to travel in a curve.

626,120—Explosive-Engine—Alexander Winton, Cleveland, O. Filed June 4, 1896. Serial No. 594,316. (No model.)

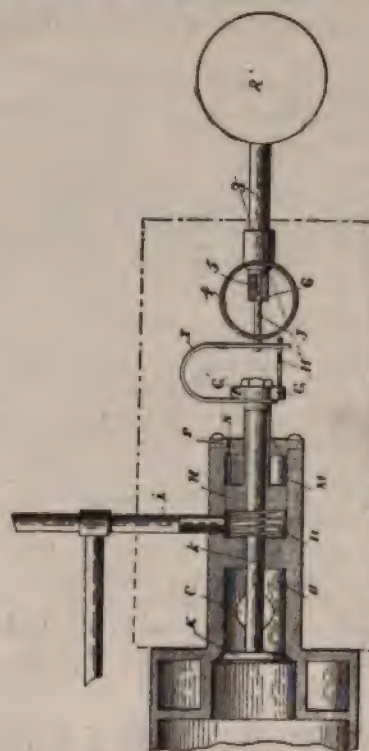
Claim.—In an explosive-engine, the combination of the cylinder having an explosive-inlet port, the valve controlling the same, a mixer in communication with the port, a



controller for the valve, a fluid-feeder in communication with the mixer, a controller for the fluid-feeder, and a level connection between the fluid-controller and the valve-controller whereby when the valve-controller is moved the fluid-controller is likewise moved and operated.

626,121—Speed-Regulator for Explosive-Engines—Alexander Winton, Cleveland, O. Filed July 27, 1898. Serial No. 687,021. (No model.)

Claim.—An explosive-engine comprising an explosive-inlet port, a cylinder or chamber projecting from the engine-cyl-

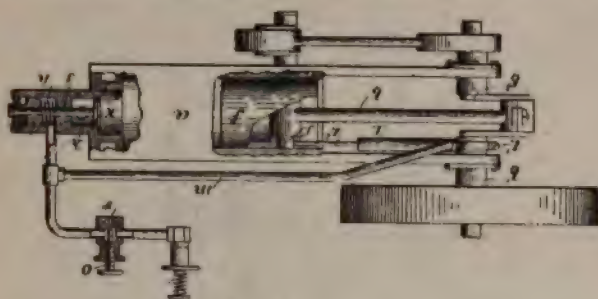


inder, a valve for the said inlet, the valve-stem passing through the said cylinder and carrying an oil-controlling valve, an oil-exit controlled by the said valve, a piston carried by the stem within the cylinder, and a cover for said cylinder, the cylinder beyond the piston having an escape whereby the valves are prevented from suddenly seating themselves.

626,122—Speed-Regulator for Explosive-Engines—Alexander Winton, Cleveland, O. Filed July 27, 1898. Serial No. 687,022. (No model.)

Claim.—In an explosive-engine the combination of an explosive-inlet port, an explosive-inlet valve therefor, a pres-

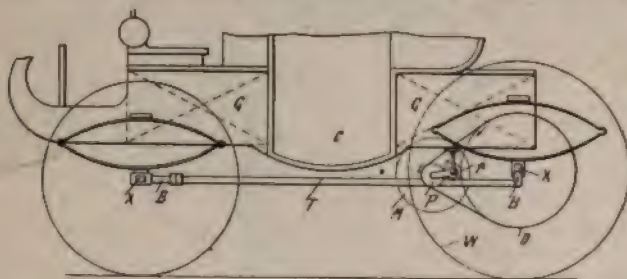
sure-actuated member connected with said valve, a pressure-producing device in communication with the said pressure-actuated member, an elongated valve-seat having its enlarged



end in communication with the pressure communication and an escape at its small end, and a valve longitudinally movable within the elongated seat in a direction toward the enlarged end of the seat.

625,772—Automotor-Carriage—Henry F. Joel, London, England. Filed Feb. 4, 1899. Serial No. 704,560. (No model).

Claim.—In combination in an automotor-carriage, a motor-suspending frame, motors carried thereon, an elliptical carriage-spring placed vertically, forming attachment be-



tween rear ends of frame and the centre of the rear driving-axle, an elliptical carriage-spring placed horizontally forming the attachment between the front ends of frame and the centre of front axle, and means for driving between motor-shaft and driving-axle adapted to permit the elastic vertical play of the former to the latter without disengagement to facilitate the starting of the motor.

626,206—Explosive-Motor—Wilhelm Jasper, New York, N. Y., assignor of one-half to Max Mindheim, same place. Filed April 19, 1898. Serial No. 678,165. (No model.)

625,839—Explosive-Engine. Lewis B. Doman, Elbridge, N. Y. Filed Feb. 4, 1898. Serial No. 669,109. (No model).

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VOLUME 4

JUNE 14, 1899

NUMBER 11

The Horseless Age

EVERY WEDNESDAY

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Interest of the
Motor Vehicle Industry.

ESTABLISHED 1895.

SUBSCRIPTION

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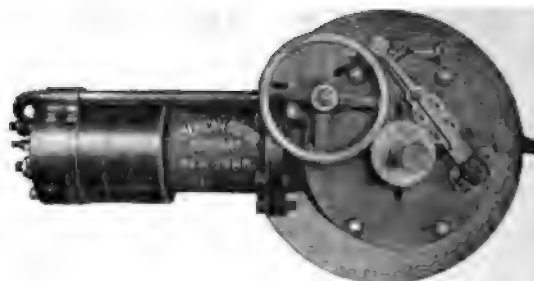
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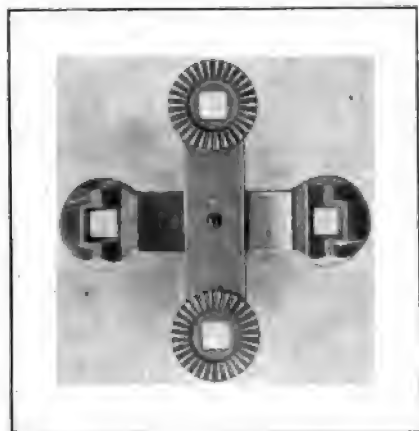
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EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. IV.

NEW YORK, JUNE 14, 1899.

No. 11.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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by New York banks on small checks under their
new rule, subscribers are requested to remit by
Post Office or Express money order or N. Y. draft.**

Automobile Club of America.

After a delay of three years and a half an effective society for the promotion of the motor vehicle has been organized in this country. The American Motor League, which was started by some of the pioneers at Chicago in the fall of 1895, languished from the first, and has long since ceased to exhibit signs of life. The time for such an organization was not ripe then, and most of the officers were so fully occupied with their private inventions and promotion enterprises as to have no spare time to devote to the purposes of the organization.

All this is changed, however. The Automobile Club of America, which had its birth at the Waldorf-Astoria Hotel last Wednesday evening, comes on the scene at a time when general interest is awakening in the new vehicle, and there is no longer doubt of its brilliant future. The gentlemen who have fathered the undertaking are well qualified to shape its policy, which in its early stages particularly must be well de-

fined and jealously guarded. The principal snare set for such societies is the insidious commercial motive which may be injected unexpectedly by some trusted officer who has the confidence of the organization. In many cases this commercial bias is a pure error of judgment, but it is none the less prejudicial to the society and should be avoided by holding it ever in view as a present danger.

The title of the club seems a trifle ambitious at this juncture. No doubt an organization of this scope will in time be needed, and its nature and purposes will be defined by the metropolitan body which now takes the initiative in motor propaganda here, but ordinary prudence suggests that the Automobile Club of America be deferred until an Automobile Club of New York is in successful operation.

The new organization has our sincerest felicitations over its auspicious beginning, and our earnest hopes for a career of growing prosperity, to which every indication points.

Only Electricians for Motormen.

We are informed by the New York *Sun* that a bill is to be introduced in the New York Legislature next fall providing that none but competent electricians shall be allowed to operate electric cabs in New York and other cities of the State. The Liberty Dawn Association of Coach Drivers and the Rising Sun Association of Livery Stable Men have determined to oppose the bill on the ground that the motor cabs will drive hundreds of horse cabs and carriages off the street, and that it is unjust to deprive the drivers of these of a chance to make a living under the new regime.

The whole question hinges upon the qualifications required of a motorman. A skilled electrician who understands all the technical points of an electric cab might make an utter failure as a motorman, and probably would, if he had had no experience in driving horses in city streets. A coachman or cabman however, who had been pursuing his vocation in the city for several years, would have the quick eye, the judgment of distance and the readiness of hand, which are the chief qualifica-

tions needed for the successful guidance of a vehicle in city streets. A knowledge of electricity would of course be a valuable acquisition, but it is not essential. The distinctly electrical part of the work is best performed by electrical engineers at the central station, whose sole duty it is to keep the cabs in proper running order. The law of specialization of industry determines this naturally and invariably, an employer finding it most advantageous to secure for any given line of work those who are most adept in that particular line, irrespective of other branches of labor.

A thoroughly competent motorman need no more be an electrician than a horse driver need be a blacksmith or a veterinary surgeon. It seems impossible that such an absurd bill could survive a preliminary discussion.

Storage Battery War.

Rumors of an impending storage battery war are rife. The General Carriage Co., which has the cheap cab charter in New York State, and which has imported from Paris two Krieger electric cabs, has under advisement the importation of a large number of them, to be put in service in New York City. These cabs utilize storage batteries made by the Parisian Electric Co., under patents claimed to antedate those of the Electric Vehicle Co., licensees of the Storage Battery Co., of Philadelphia, which sets up a claim to the ownership of every storage battery patent that is of any value in the United States. The Storage Battery Co. therefore threatens suit for infringement if the carriage company introduces Krieger cabs in the city, and so the war of words goes on.

Meantime, it is pertinent to ask why the storage battery monopoly, as it is termed, has not enjoined the four enterprising concerns that have been making electric vehicles in the United States for some time past, using batteries of their own, and whose combined display at the late Electrical Exhibition was three times as great as that of vehicles fitted with monopoly batteries. Here, surely, is an opportunity to establish a strong precedent, and warn off competitors who might, in future, undertake to dispute the sway of the monopoly. So far as can be learned, however, no such measures have been taken, or are in contemplation. With these rigorous competitors already in unchallenged possession of the field, and with the prospect of new competition springing up as the field widens, the outlook for storage battery monopolies can scarcely be called cheerful. Patent litigation is expensive at best, and if persevered in, is likely to play sad havoc with dividends, especially on inflated stock.

Charron-Winton Race.

There is a hitch in the negotiations for the Charron-Winton race. M. Charron wants 100,000 francs and nothing less, for stakes. Mr. Winton declines to put up more than the 20,000

francs which he has already placed in the hands of a New York newspaper, looking upon M. Charron's demand as smacking too much of gambling. In the event of his defeat the Frenchman agrees to place an order with the victor for 1,000,000 francs worth of machines of the same type as the winning carriage.

The Frenchman is evidently eager for a race, but, on the other hand, Mr. Winton's position is certainly defensible. If the object of the race is pure sport, the stakes need not be larger than enough to pay expenses and leave a moderate sum to the good.

Automobile Club Organized.

The preliminary steps to the organization of an automobile club in New York City were taken at the Waldorf-Astoria Hotel last Wednesday evening, when some thirty persons interested in the motor vehicle responded to the call of Whitnev Lyon and George F. Chamberlain.

In his opening remarks Mr. Lyon said facetiously that an automobile club was needed in order to protect users of motor carriages from park boards on the one hand and from motor vehicle manufacturers on the other, the park boards excluding motors from their domains, and the manufacturers keeping purchasers on the string for months.

Mr. Lyon said that the necessity of a club was forced upon him by the difficulty he encountered in trying to find a livery stable keeper who would store and care for his motor carriage. When the proprietor of a stable learned that the vehicle was horseless he looked upon it as an enemy to his business and not to be harbored at any price.

Mr. Chamberlain was elected temporary president, and read the following concise statement of the objects of the organization:

To supply the pressing need of a common center where all present or prospective owners of motor pleasure vehicles may exchange views, and take suitable action looking to the development of the sport in the United States, and particularly in and about Greater New York.

To establish a depot for the proper storage and care of vehicles, and where all forms of automobiles, whether using gasoline, compressed air, electricity, steam or other motive power, may be properly housed and cared for by competent mechanics, and where supplies of all kinds for the purpose will be kept.

To furnish a means of recording the combined experience of users of various forms of motor vehicles all over the world, which will surely lead to rapid improvements, and be of great benefit to all interested in the progress of their manufacture.

To encourage hospitality, notably in the entertainment of visitors from other cities, or from neighboring or foreign clubs.

To assist in the organization of competitive races, and other road events.

To collect a general library of literature on motor vehicles in this country. It is proposed to make the club a center of such information, and to gradually accumulate a valuable library on the subject, through foreign and domestic exchanges, and other sources, following the rapid development of the automobile in the broadest sense, in all fields where the various forms of mechanical energy will displace the animal.

To provide a starting point and center for runs and excursions. This has been a recognized feature of the successful clubs in France and England.

To promote the cause of good roads, which for the automobile are paramount. In this matter the users of all motor vehicles should and will be prepared to co-operate in favor of an active propaganda to secure legislation for the improvement of the condition of our city streets, as well as the common highways of the country. In this most important matter the proposed club should take an active and efficient part.

To make the usual and special exchange of courtesies of the club with other desirable clubs both here and abroad. In view of the near approach of the Paris Exposition it is suggested that cordial relations be established with the English and French clubs as soon as possible.

To arrange for the reading of papers bearing upon the development of the various forms of vehicles, by members of the club and by specialists. This has also been a valuable feature of the foreign clubs. It offers members an opportunity of pursuing original investigation along the lines of any of the forms of energy which have already been successfully applied to road vehicles, so that the club shall constitute itself, in its broadest sense, a society for the encouragement of the motor vehicle.

To establish sound precedents in regard to the proper use of motor vehicles, either in city or country. Unless an example is set by members of the club of the proper use of vehicles upon the highways of this country, unfavorable legislation will be sure to follow. It should be the effort and aim of the club to co-operate in obtaining rational legislation, and to discourage improper speeding or dangerous use of motor vehicles, and in all ways to avoid exciting the prejudice and hostility of horse owners. The motor vehicle should be considered as a valuable ally of the horse, and not as his natural enemy.

To develop the social features of the club, and in order to secure this, to eliminate trade interests, the organization should be broad enough to include all owners of motor pleasure vehicles, of good social standing, and to strictly exclude any effort on the part of manufacturers to push any particular form of motor carriage through membership in this club.

Generally, to secure all the advantages which any well-appointed and properly organized club, devoted to sport, should have; including, of course, a well-appointed club-house in this city, centrally located.

W. E. Busby was elected temporary treasurer and Homer W. Hedge temporary secretary, and the meeting was then thrown open for discussion.

The first task before the meeting after preliminary business had been dismissed was the selection of a name. The Automobile Club of America was finally settled upon, and it was suggested that the cable be used to notify the foreign automobile clubs of the birth of the new organization, but action was deferred until the incorporation could be effected.

The chairman was authorized to appoint a committee of five, to draft a constitution and by-laws to be submitted at the next meeting, to be held in September. He selected W. D. Walker, Whitney Lyon, General George Moore Smith, Dr. F. C. Hollister and William H. Hall.

Among those present were: A. L. Riker, A. H. Whiting, Thomas Proctor, Major Gibson, Dr. Geo. Evans, R. H. Plass, J. B. Hoecker, Jr.; W. E. Busby, Dr. Henry Power, General Geo. Moore Smith, J. I. Brandenburg, Henry W. Struss, John J. Prendergast, S. H. Valentine, George F. Chester, Dr. E. C. Chamberlain, Homer W. Hedge, Whitney Lyon, Herbert Lloyd, W. D. Walker and E. P. Ingersoll.

Annual Report of the Electric Storage Battery Co.

President Isaac L. Rice, of the Electric Storage Battery Co., of Philadelphia, rendered his annual report yesterday, showing the company's connection with the various electric vehicle companies which are using its batteries. The company, according to the report, owns five-twelfths of the business controlled by the Electric Vehicle Co., and the Columbia Automobile Co. These two companies have united and organized a company called the Columbia Electric Vehicle Co., for the purpose of manufacturing all parts of electric vehicles except the storage batteries, which will be furnished by the Columbia Automobile Co. The entire product of this company will be purchased by the Electric Vehicle Co., and sold by it to the various electric vehicle transportation companies that are to be organized.

A striking increase in the business of the Electric Storage Battery Co. is shown. For the first five months of 1899 the sales amounted to \$1,360,560.70, as against \$314,498.33 for the same period in 1898. The sales from January 1, 1898, to January 1, 1899, were \$1,340,967.64, as against \$1,026,925.65 the preceding year.

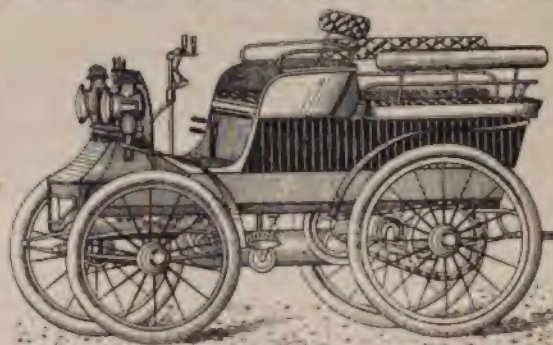
The treasury resources of the company, after providing for all bonded and floating indebtedness, are given as \$102,374.38.

LONDON NOTES.

LONDON, June 2, 1899.

NEW PETROLEUM CARRIAGES.

The number of types of petroleum carriages now being manufactured on a commercial scale on this side is steadily increasing, and the would-be motorist in England is beginning to be "spoilt by choice," finding it no easy matter to make a selection from the many types offered him. The Daimler carriages still lead the way, but the number of builders of petroleum motors in England is steadily growing. Quite a number of concerns have built or are building experimental vehicles, but until recently the only concern which had made a commercial start beyond the Daimler and Roots was the Star Motor Co., Ltd., of Wolverhampton. To this list, however, another name has now to be added—that of Marshall & Co., who have taken the works at Clayton, Manchester, formerly owned by the Belsize Cycle Co. This firm has acquired the English rights in the French Hurtu gasoline carriages and has established a plant to manufacture these completely in England. The carriage is provided with a motor of the Benz type, but in the transmission and control gear there are many points of



DUROISSET GASOLINE CARRIAGE.

difference. Several new continental-built carriages have also lately been put on the English market. The Automobile Association is just now pushing the "Hercules" carriage, built by Ducroiset, of Grenoble, and of which I sent you some brief particulars the other week, and of which I am now able to furnish a general view. This concern has also introduced an improved form of the "Orient Express" carriage built by Bergmann of Gaggenau, Germany, and is also on the point of introducing a gasoline motor cab built in Berlin, the feature of which is that the motor and the transmission gear are mounted on the fore carriage, thus enabling any horse-drawn vehicle to be converted into a motor-carriage by the substitution of the front pair of wheels for the *avant-train*. This carriage is known as the Kuhlstein-Vollmer system. Friswell, of Holborn Viaduct, in addition to Benz cars, is also now pushing Hurtu's, Moir's and Decauville's, while he is also reported to have made arrangements to introduce a new French carriage, of which great things are expected. Finally mention may be made of the new German-made Daimler carriage, which has been put on the market by the Motor-Carriage Supply Co., Ltd., of Norfolk street, Strand, London, W. C. The construction of this car, although the motor is located in front as usual, differs considerably from the ordinary Daimler-Panhard system, particularly as regards the speed, varying gear and cylinder-cooling arrangements. The water tank, which only contains $2\frac{1}{2}$ gallons of water, is located in front of the carriage. It is filled with a series of tubes through which cold air is forced by means of a fan on the crank shaft of the motor. It is claimed that by this arrangement the water is never allowed to get overheated and that in fact the evaporation of water has been reduced to $1\frac{1}{2}$ pints for an eight-hours' run. The steering gear has been modified, while special attention has been paid to the suspension of the body of the carriage on the frame, with the object of reducing vibration.

Some trials with motor-wagons are, it is announced, to be made in connection with the Austrian military manoeuvres shortly to be held in North Bohemia. The vehicles are to be employed in the commissary service.

It is a noticeable feature of the motor-vehicle movement in England, that although a considerable degree of success has been achieved by builders of steam-vehicles, these are all of a heavy type, there being no one, so far, who has achieved any practical result with light steam carriages of the type introduced in America. One of the few concerns which has done something in the way of a light two or three-seated steam carriage is the Clarkson-Capel Steam Car Syndicate, of London, S. E., but so far, however, very little has been seen or heard of their products.

A new gasoline vehicle motor is about to be put on the market by D. Napier & Son, of Vine street, Lambeth, London, S. E. It is reported as of the vertical twin cylinder type, capable of developing up to 7 brake H. P.

Very little has been heard for some time past of what is being done in the way of motor vehicles by Humber & Co., Ltd., of Coventry, the well-known cycle makers. It is said, however, that a carriage has lately been completed, fitted with a new gasoline motor, the trials of which have given great satisfaction.

E. Phillips, of Phillips, Ormonde & Co., Melbourne, Australia, has recommended the Postmaster General of Victoria to adopt steam vans instead of the horse vans now employed to carry the mails. A trial will be made, and American makers of suitable vehicles are invited to communicate with Postmaster General Duffy.

Shunt Motors for Electric Vehicles.

By P. M. HELDT.

The traveling range of electric vehicles, which is usually none too great on a good level course, is seriously reduced when the roads traveled over are hilly, or when the conditions of the road, or the load carried, are such as to require an abnormal amount of power. The reduction of the range under such conditions is considerably greater than could be accounted for simply by the increased traction. We must therefore look for other causes, and these are to be found in the lower efficiency of the electric motor when greatly overloaded, and the reduced capacity of the storage battery when discharged at an abnormal rate.

Electric vehicles have so far only been built for use on city pavement, and mostly for cities in which grades are few and light, and this probably is responsible for the fact that little or nothing has been done to increase the hill-climbing efficiency of these vehicles. By hill climbing efficiency we do not mean the ability to climb hills, as in this respect electric vehicles are, as a rule, satisfactory, and superior to gasoline vehicles, but what is meant is the ratio of the actual power required to propel the vehicle up a certain grade to the loss of battery charge ensuing in going up the grade.

The type of motor almost universally used on electric vehicles is what is known as the series motor, which possesses the characteristic feature that the excitation of the field is produced by the same current that passes through the armature. The speed regulation of the vehicle is entirely effected by varying the speed of the motor. The speed of the motor is governed by a controller, by means of which the groups of battery cells can be connected in different ways, so that three different pressures, usually 20, 40 and 80 volts, can be applied to the motor terminals. Sometimes two motors are employed and these connected in series and in parallel by the controller, which gives the same results. Some manufacturers supplement the series-parallel control, as the above system is termed, by a variation of the number of turns of the field coil, and thus obtain four and even five speed variations. To this system of electric speed control is in a great measure due what has been called the ideal simplicity of the electric vehicle, but it also bears the responsibility for very uneconomical operation under certain conditions, especially in mounting heavy grades. It may here be mentioned that the position of the controller which gives the highest speed also gives the greatest turning effort on the wheels. This condition, which is the exact reverse of that obtaining in all mechanical forms of speed regulation, makes it necessary to climb all grades of considerable steepness with the controller lever at the high speed notch.

A vehicle weighing with passengers a ton, and running at a speed of 12 miles an hour, consumes on good level road from 18 to 20 amperes at 80 volts. Such a vehicle would be equipped with a motor of 2 H. P. nominal capacity, and the motor would be worked at nearly its nominal rating on level track. For hill climbing the overload capacity of the motor is depended upon. Now to mount a 10 per cent. grade it requires a tractive force of five times that required on the level, assuming the traction coefficient on the level to be 25 lbs. per 1,000 lbs. As the speed reduction from motor shaft to driving wheel remains the same, the motor has to produce a proportionate increase in turning effort or torque. Two of the variable quantities connected with the operation of the motor—the field magnetism and the current—respond to this demand

for greater turning effort. The field magnets, however, are usually worked near the point of saturation at the normal load of the motor, and the greatest possible increase of the field magnetism would probably not be more than 25 per cent. The armature current will therefore have to rise to four times its normal value to give in conjunction with the 25 per cent. additional field strength a turning effort of five times the normal.

The electrical efficiency at ordinary load we will assume to be 88 per cent. This is a pretty good figure, and rather hard to attain in such small machines, especially if light weight is the main consideration in view in designing. Of the total energy absorbed by the motor 12 per cent. is lost in heat in the windings, while the rest is transformed into mechanical energy. The percentage of energy wasted in the windings is proportional to the current (supposing the pressure at the motor terminals to be constant), and in the case of mounting the 10 per cent. grade the loss in the windings would therefore amount to 48 per cent., leaving a useful effect of 52 per cent.

The energy required to propel the vehicle up the grade was five times the energy it would require to move the vehicle an equal distance on the level, but owing to the decrease in efficiency of the motor from 88 per cent. to 52 per cent. the consumption of electrical energy by the motor is nearly 8.5 times what it would have been on a level course. This figure, while measuring the energy given out by the battery, does not represent the depreciation of the battery charge. As is well known, the capacity of an electric storage battery is dependent upon the rate of discharge. Formerly batteries were rated at the capacity corresponding to a ten-hour discharge, but since the advent of the electric vehicle batteries have been standardized for this line of work, and for these the three-hour discharge capacity has become normal. The batteries in the vehicle under consideration, when giving 18 to 20 amperes, while running on the level, would be discharging at about their normal rate; but when in going up the grade they furnish about four times this current they discharge at an excessive rate. The relative reduction of the capacity depends to quite a degree upon the make of the battery, but in any case, if fully discharged at this rate, the capacity would hardly be more than one-half the capacity at a three-hour discharge. Penhert has made experiments on a large number of batteries to determine the relation between rate of discharge and capacity. His results show that with batteries most suitable to a high rate of discharge increasing the discharging current four times reduces the capacity to nearly one-half, while with batteries least favorable to high rates of discharge the decrease in capacity is much greater. Naturally only the first class of battery is used for motor vehicle work, and we will therefore not be far wrong in applying the figure given for this type to the battery under consideration. To mount a 10 per cent. grade therefore entails a loss of battery charge of about sixteen times that produced by running through a level course of equal length. In descending the grade the best that can be done is to shut off the current from the motor altogether and drift down on the brake, as the series motor will take current from the battery, no matter at what speed it is running.

The foregoing example explains the inefficiency on hilly roads of electric vehicles as at present constructed. To improve the efficiency of hill climbing we have to reduce the load of the motor, which renders the latter more efficient and at the same time decreases the rate of discharge of the battery. We also have to recuperate some of the energy stored up in the vehicle in going up the grade while descending it. These two objects can be accomplished by providing the vehicle with

a shunt motor and a variable mechanical gear or speed-reducing device.

The series motor is almost universally used in electric railway practice, and the similarity in the conditions of operation seems to have led designers of electric vehicles to adopt it in their work. The advantages claimed for the series motor are the following: (1) Great starting torque, (2) automatic variation of the speed with load; (3) greater safety from burn-outs than the shunt motor, and (4) better speed control. The characteristics of the shunt motor are: (1) almost constant speed within the limits of the normal load, and (2) that it will reverse its action and send a charging current through the battery when driven above this critical speed by some external force, for instance the force of gravity in descending grades.

If we examine the claims made for the series motor we find that the first advantage, the greater starting torque, although of great importance in vehicles with unvariable gear, loses its weight when a variable gear has been provided, and the vehicle can be started up on the slow gear, and when started thrown on the high gear by means of a friction clutch. The second advantage, the automatic variation of the speed with the load, is somewhat doubtful, looking at it in a general way, and becomes a distinct disadvantage in descending grades. With the low voltages used in motor vehicle work a shunt motor is practically just as safe as a series motor, and the author knows from experience that shunt motors are perfectly safe at this voltage if properly constructed. The mechanical speed control by the variable gear reduces the number of speed variations required of the motor, and thus makes up for the defections of the shunt motor in this respect.

With a variable gearing the series motor is not in any way superior to the shunt motor, and the latter possesses the advantage of the recuperating quality, which is brought into play in slowing the speed of the vehicle down and in descending grades.

To get an idea of the advantages of this system for travel over hilly roads we suppose the vehicle considered before to be equipped with a shunt motor and a variable gear of a ratio of 1:3. The motor may run at two speeds, one one-half the other. If geared to a maximum speed of 12 miles an hour, as before, the four speeds of the vehicle would be 12, 6, 4 and 2 miles an hour. The 10 per cent. grade would be climbed at the 4 mile speed. The tractive force required is again five times that on the level, but as the speed reduction from motor shaft to driving wheels is three times greater, the torque produced by the motor is only one and two-thirds the torque at high gear on the level. In a shunt motor the magnetic field remains practically constant, and the armature current is therefore directly proportional to the torque. Another feature of the shunt motor is that as the field excitation remains constant only the armature losses increase with the current. The extra speed reduction decreases the efficiency of the gearing somewhat. The extra losses in the armature and in the gearing bring the efficiency down to about 75 per cent., and the draught of current from the battery will be twice that on level road. At this rate of discharge the battery capacity is less in the ratio of 1:1.42 than the capacity at normal discharge. Bearing in mind that we are geared three times as slow as ordinarily the loss of battery charge in this case amounts to $3 \times 2 \times 1.42 = 8.5$ times the loss of charge on an equal stretch on the level, or just one-half as much as in the case of the series motor and unvariable gear.

Now, in descending the grade about 30 per cent. of the energy consumed during the ascent can be recuperated if conditions are favorable. This brings the figure of the battery loss from 8.5 down to 6.7. This figure, although still very large when it is considered that the actual energy required to ascend and descend a grade, is no more than that required to go through an equal parcours on the level, and that it only represents a measure of the inefficiency of the power storing and converting apparatus, due to the great variation of the load on the motor, which is positive in ascending and negative in descending—is nevertheless a great improvement over the figure found for the ordinary type of vehicle.

In addition to the increased economy we have the advantages of a greatly increased propelling effort, and the possibility of charging the battery with the motor run as dynamo wherever mechanical power is available.

In going over a summit, if the speed adjustment of the vehicle is not changed the recuperating action of the motor goes into effect gradually. But when on a down grade or on the level the speed of the vehicle is reduced and the lever by which this speed reduction is effected is moved suddenly, we have of necessity an impulsive retardation of the vehicle. Changing the position of the controller lever from high voltage to low voltage produces only a barely perceptible jar, while a very strong braking action results if the clutch is suddenly changed from high to low gear. In the first case the vehicle is retarded by an increased electric resistance, while in the second case the mechanical inertia of the motor armature plays the most important part. The gear must therefore never be changed suddenly, and not be changed at all when on a down grade.

The writer does not believe that the shunt motor and variable gear solve all the difficulties connected with electric vehicle practice, nor that they are to be commended in every case, but it is his opinion that where the roads to be traveled over are hilly, and their condition is not of the best, this system offers advantages which greatly outweigh the slight increase in complication in the power transmission and the controlling apparatus.

Grades and Horse Powers.

By HARRY E. DEY.

Many readers of THE HORSELESS AGE will find the accompanying table convenient for determining the horse power required to propel vehicles at various speeds and on different grades.

In making these calculations the amount required on the level was based on the assumption of fifty pounds pull per short ton, which is about the average requirement on good city pavements. No allowance has been made for wind resistance, which is ever an uncertain quantity.

The table is divided into two parts, the power required on the level and the additional amount required for grades. On down grades of course the latter will be subtracted, and if greater than that required to propel on a level the difference will be returned to the battery, in case of a regenerative controller, or consumed in the brakes, assuming that the speed is kept constant.

The figures given in the table are for each 100 pounds, so they should be multiplied by the number of hundreds of pounds in the total weight of vehicle. To use the table for power required on a level select from the column marked "horse power per hundred pounds on level" the number cor-

responding to the miles per hour and multiply it by the number of hundreds of pounds weight; this will give the horse power required.

For power required on grades find the amount required on the level as in the first case and add (if ascending grade) to this the number found at the intersection of the grade and speed columns, after multiplying the latter by the weight of the vehicle in hundreds of pounds.

EXAMPLES.

What horse power is required to drive a 2,000 pound vehicle 25 miles an hour on a good level road?

We find in column of "horse-power on level" corresponding to 25 miles the decimal .1667, then multiplying this by weight in hundreds $.1667 \times 20 = 3.334 =$ required horse power.

How much power is required to ascend a 12 per cent. grade at a speed of 10 miles an hour, with a vehicle weighing 700 pounds?

At the intersection of the columns, "12 per cent." and "10 miles per hour," we will find the decimal .3200, adding to this the decimal .0667 (the amount required on the level), $.3200 + .0667 = .3867$, multiplying this sum by 7, the weight of the vehicle in hundreds, $.3867 \times 7 = 2.7069$ horse power.

How much power is returned to the batteries with a regenerative system in descending a 9 per cent. grade at a speed of 15 miles, the weight of the vehicle being 2,000 pounds?

We find by the previous method the grade power to be .3600 per 100 pounds; subtracting this from the amount required to drive on a level, $.2600 - .1000 = .2600$. Multiplying this by weight, $.2600 \times 20 = 5.200$, and as there will be a loss in transmission between the wheel rim and battery of about 30 per cent., we will multiply this result by .70; $5.20 \times .70 = 3.64$ horse power put into the battery.

By an inspection of the table it will be noticed that the critical point where the power required and the amount produced by grade is at $2\frac{1}{2}$ per cent.; that is a $2\frac{1}{2}$ per cent. grade will just keep a vehicle coasting at a steady speed.

It should be remembered that the figures given in the table are for the power delivered at the rim of the wheels, so that in figuring on the motor allowances should be made for loss in transmission between the motor and the wheels, which in some cases is as high as 50 per cent. Liberal allowances should also be made for extreme cases of sand, mud, broken stone, etc.

ADDITIONAL OBSERVATIONS.

It takes a pull at the rim of the wheels equal to half the weight of a vehicle to obtain a speed of eleven miles an hour in one second.

The energy stored in the momentum of a vehicle traveling eleven miles an hour is equal to lifting it bodily eight feet.

Dr A. J. Zabriskie, Flatbush, N. Y., who has used a Winton carriage in his practice for the past year, states that it has saved him \$600, as compared with the cost of two horses which he formerly kept to do the work. In fact, the motor carriage will do much more than the two horses.

The C. H. Black Mfg. Co., Indianapolis, Ind., have issued a catalogue of their gasoline motor vehicles, of which five styles are shown—a ten passenger wagonette, a light delivery, a physician's phaeton, a dos-a-dos trap and a business wagon. Motors of $2\frac{1}{2}$ to 8 H. P. are employed.

THE HORSELESS AGE.

No. 22, June 14, 1899.

Speed, miles per hour.	Horse-power required per 100 lbs. on level.	PER CENT. GRADE (to be added to that required on level).																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	.0067	.0027	.0053	.0080	.0107	.0133	.0160	.0187	.0213	.0240	.0267	.0293	.0320	.0347	.0373	.0400	.0427	.0453	.0480	.0507	.0533	.0560	.0587	.0613	.0640	.0667
2	.0133	.0053	.0107	.0160	.0213	.0267	.0320	.0373	.0427	.0480	.0533	.0587	.0640	.0693	.0747	.0800	.0853	.0907	.0960	.1013	.1067	.1120	.1173	.1227	.1280	.0133
3	.0200	.0080	.0160	.0240	.0320	.0400	.0480	.0560	.0640	.0720	.0800	.0880	.0960	.1040	.1120	.1200	.1280	.1360	.1440	.1520	.1600	.1680	.1760	.1840	.1920	.0200
4	.0267	.0107	.0213	.0320	.0427	.0533	.0640	.0747	.0853	.0960	.1067	.1173	.1280	.1387	.1493	.1600	.1707	.1813	.1920	.2027	.2133	.2240	.2347	.2453	.2560	.0267
5	.0333	.0133	.0266	.0400	.0533	.0667	.0800	.0933	.1067	.1200	.1333	.1467	.1600	.1733	.1867	.2000	.2133	.2267	.2400	.2533	.2667	.2800	.2933	.3067	.3200	.0333
6	.0400	.0160	.0320	.0480	.0640	.0800	.0960	.1120	.1280	.1440	.1600	.1760	.1920	.2080	.2240	.2400	.2560	.2720	.2880	.3040	.3200	.3360	.3520	.3680	.3840	.0400
7	.0467	.0187	.0373	.0560	.0747	.0933	.1120	.1306	.1493	.1680	.1867	.2053	.2240	.2427	.2613	.2800	.2987	.3173	.3360	.3547	.3733	.3920	.4107	.4293	.4480	.0467
8	.0533	.0213	.0427	.0640	.0853	.1067	.1280	.1493	.1707	.1920	.2133	.2347	.2560	.2773	.2987	.3200	.3413	.3627	.3840	.4053	.4267	.4480	.4693	.4907	.5120	.0533
9	.0600	.0240	.0480	.0720	.0960	.1200	.1440	.1680	.1920	.2160	.2400	.2640	.2880	.3120	.3360	.3600	.3840	.4080	.4320	.4560	.4800	.5040	.5280	.5520	.5760	.0600
10	.0667	.0267	.0533	.0800	.1067	.1333	.1600	.1867	.2133	.2400	.2667	.2933	.3200	.3467	.3733	.4000	.4267	.4533	.4800	.5067	.5333	.5600	.5867	.6133	.6400	.0667
11	.0733	.0293	.0587	.0880	.1173	.1467	.1760	.2053	.2347	.2640	.2933	.3227	.3520	.3813	.4107	.4400	.4693	.4987	.5280	.5573	.5867	.6160	.6453	.6747	.7040	.0733
12	.0800	.0320	.0640	.0960	.1280	.1600	.1920	.2240	.2560	.2880	.3200	.3520	.3840	.4160	.4480	.4800	.5120	.5440	.5760	.6080	.6400	.6720	.7040	.7360	.7680	.0800
13	.0867	.0347	.0693	.1040	.1387	.1733	.2080	.2427	.2773	.3120	.3467	.3813	.4160	.4507	.4853	.5200	.5547	.5893	.6240	.6587	.6933	.7280	.7627	.7973	.8320	.0867
14	.0933	.0373	.0747	.1120	.1493	.1867	.2240	.2613	.2987	.3360	.3733	.4107	.4480	.4853	.5227	.5600	.5973	.6347	.6720	.7093	.7467	.7840	.8213	.8587	.8960	.0933
15	.1000	.0400	.0800	.1200	.1600	.2000	.2400	.2800	.3200	.3600	.4000	.4400	.4800	.5200	.5600	.6000	.6400	.6800	.7200	.7600	.8000	.8400	.8800	.9200	.9600	.1000
16	.1067	.0427	.0853	.1280	.1707	.2133	.2560	.2987	.3413	.3840	.4267	.4693	.5120	.5547	.5973	.6400	.6827	.7253	.7680	.8107	.8533	.8960	.9387	.9813	.10240	.1067
17	.1133	.0453	.0907	.1360	.1813	.2267	.2720	.3173	.3627	.4080	.4533	.4987	.5440	.5893	.6347	.6800	.7253	.7707	.8160	.8613	.9067	.9520	.9973	.10427	.10880	.11333
18	.1200	.0480	.0960	.1440	.1920	.2400	.2880	.3360	.3840	.4320	.4800	.5280	.5760	.6240	.6720	.7200	.7680	.8160	.8640	.9120	.9600	.10080	.10560	.11040	.11520	.12000
19	.1267	.0507	.1013	.1520	.2027	.2533	.3040	.3547	.4053	.4560	.5067	.5573	.6080	.6587	.7093	.7600	.8107	.8613	.9120	.9627	.10133	.10640	.11147	.11653	.12160	.12667
20	.1333	.0533	.1067	.1600	.2133	.2667	.3200	.3733	.4267	.4800	.5333	.5867	.6400	.6933	.7467	.8000	.8533	.9067	.9600	.10133	.10667	.11200	.11733	.12267	.12800	.13333
21	.1400	.0560	.1120	.1680	.2240	.2800	.3360	.3920	.4480	.5040	.5600	.6160	.6720	.7280	.7840	.8400	.8960	.9520	.10080	.10640	.11200	.11760	.12320	.12880	.13440	.14000
22	.1467	.0587	.1173	.1760	.2347	.2933	.3520	.4107	.4693	.5280	.5867	.6453	.7040	.7627	.8213	.8800	.9387	.9973	.10560	.11147	.11733	.12320	.12907	.13493	.14080	.14667
23	.1533	.0613	.1227	.1840	.2453	.3067	.3680	.4293	.4907	.5520	.6133	.6747	.7360	.7973	.8587	.9200	.9813	.10427	.11040	.11653	.12267	.12880	.13493	.14106	.14720	.15333
24	.1600	.0640	.1280	.1920	.2560	.3200	.3840	.4480	.5120	.5760	.6400	.7040	.7680	.8320	.8960	.9600	.10240	.10880	.11520	.12160	.12800	.13440	.14080	.14720	.15360	.16000
25	.1667	.0667	.1333	.2000	.2667	.3333	.4000	.4667	.5333	.6000	.6667	.7333	.8000	.8667	.9333	.10000	.10667	.11333	.12000	.12667	.13333	.14000	.14667	.15333	.16000	.16667
26	.1733	.0693	.1387	.2080	.2773	.3467	.4160	.4853	.5547	.6240	.6933	.7627	.8320	.9013	.9707	.10400	.11093	.11787	.12480	.13173	.13867	.14560	.15253	.15947	.16640	.17333
27	.1800	.0720	.1440	.2160	.2880	.3600	.4320	.5040	.5760	.6480	.7200	.7920	.8640	.9360	.10080	.10800	.11520	.12240	.12960	.13680	.14400	.15120	.15840	.16560	.17280	.18000
28	.1867	.0747	.1493	.2240	.2987	.3733	.4480	.5227	.5973	.6720	.7467	.8213	.8960	.9707	.10453	.11200	.11947	.12693	.13440	.14187	.14933	.15680	.16427	.17173	.17920	.18667
29	.1933	.0773	.1547	.2327	.3093	.3867	.4640	.5413	.6187	.6960	.7733	.8507	.9280	.10053	.10827	.11600	.12373	.13147	.13920	.14693	.15467	.16240	.17013	.17787	.18560	.19333
30	.2000	.0800	.1600	.2400	.3200	.4000	.4800	.5600	.6400	.7200	.8000	.8800	.9600	.10400	.11200	.12000	.12800	.13600	.14400	.15200	.16000	.16800	.17600	.18400	.19200	.20000

COMPUTED BY HARRY E. DEY.

OUR FOREIGN EXCHANGES.

Light Swiss Three-Wheeler.

The light vehicle of which we give herewith a photograph hails from Switzerland, where it is meeting with a considerable amount of success, owing chiefly to its extraordinary hill-climbing capacity. This is no mean feature in a country where steep grades abound, for, although the Swiss roads have been splendidly engineered, there is much hard and long, tremendously long, climbing to be done. The car is of the three-wheeled pattern, and resembles in its general outlines the Bollée, from which it is, however, quite different in its mechanical details. Our correspondent tells us the motor is of the horizontal, single-cylinder type, water-jacketed, electric ignition, and of about three and a half to four horse-power. Its position, low down in the center of the vehicle, between the three wheels, gives the car great stability, and totally overcomes the side-slipping so common with the three-wheeled variety.

The cooling water (about six gallons) is contained in an arch-shaped tank, which, placed over the driving wheel, serves at the same time as a most effective mud guard.

The transmission of power and variation of speed are obtained in a simple and effective manner by a single belt and a set of spur wheels, which, acting directly on the driving wheel, give two main speeds of eight and twenty miles an hour, all intermediate speeds being obtained by regulating the motor and the electric ignition, as in the Benz cars. Thus geared, the car, we are assured, will climb with its two passengers aboard hills of one in five; it can also be geared to travel at thirty miles an hour, when it will still ascend hills of about one in eight.

The seat, which contains the ignition apparatus, tools, etc., is well suspended on a couple of good carriage springs, and is most comfortable. The hind part of the frame can easily be

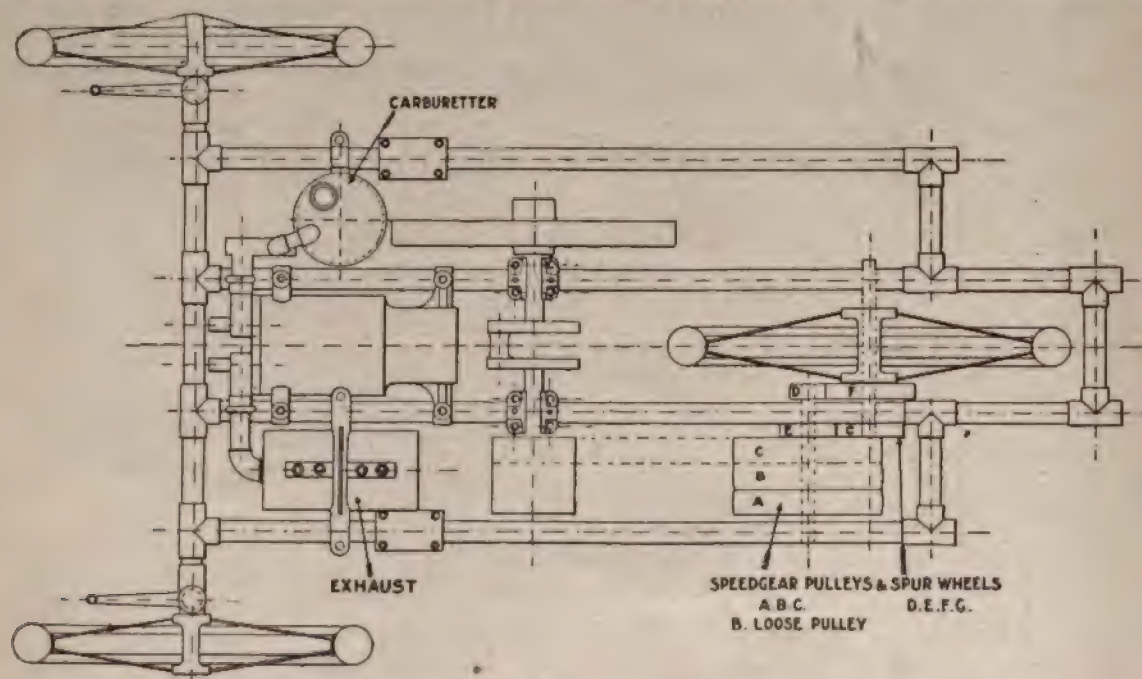


accommodated to carry a certain amount of baggage, which is thus placed entirely out of the way.

This new car, with its handy dimensions and moderate weight (about 225 kilos.), strikes us as being one of the most practical on the market. The retail price is about £120, fitted with two and a half inch front and three and a half inch back Michelin pneumatic tires. The whole mechanism is exceedingly simple, and easily get-at-able in case of repairs being necessary, and for cleaning purposes. — *Autocar*.

The Burger Elastic Tire and Rim.

Franz Burger, of Fort Wayne, Ind., who has taken out many patents on gas engines, is also the inventor of an elastic tire especially designed for heavy vehicles, which is claimed

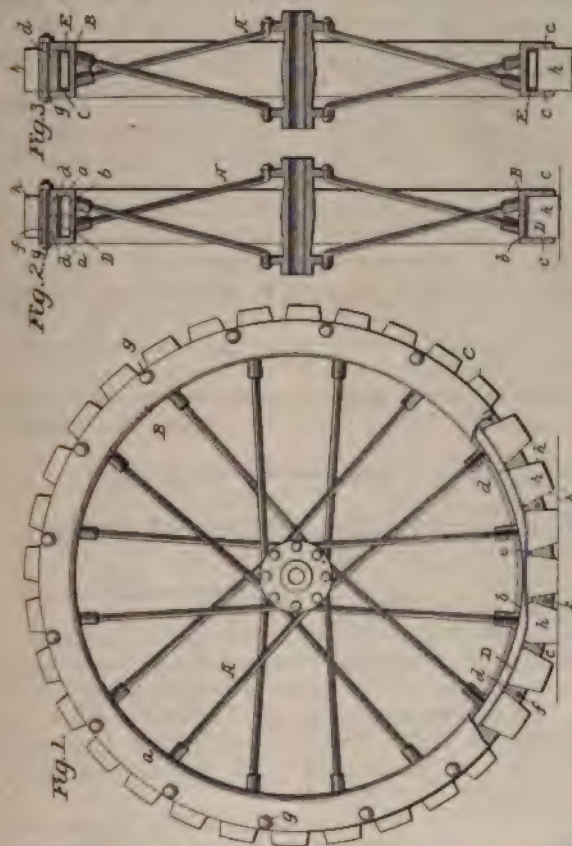


LIGHT SWISS THREE-WHEELER.

to be easy of application and repair, not liable to serious injury by contact with sharp objects, and in cushioning effect almost equal to pneumatic.

Fig. 1 is a side elevation, partly in section, of a wheel provided with this tire. Fig. 2 is a central cross-section, and Fig. 3 is a similar view showing a modification. A designates a wheel, and B the rim. In Figs. 1 and 2 the rim is composed of two similar rings or sections a a, each of an approximate L shape in cross-section, so that when properly secured together side by side the rings or sections form a trough-like rim with a flat bottom b and parallel sides c c.

The sides of the sections a a are each provided at regular and uniform distances apart with inwardly projecting portions or studs a, so disposed that when the sections are in their proper relation the opposing studs are in line with each other, and thus extend from side to side of the rim. These studs are wedge-shaped in transverse section, Fig. 1, and are arranged with the narrow edge e toward the bottom of the rim, although more or less distant therefrom. At suitable points openings f extend through the sections a and studs d to permit the passage of bolts.



The tire C is formed of a series of separate cushions or blocks h, of some suitable yielding or compressible material, as vulcanized rubber, fitted snugly into the spaces or pockets formed by the sides of the rim and the transverse portions or studs d, the outer ends of the blocks projecting beyond the periphery of the rim to any desired extent and forming the tread portion of the tire. The sides h' of these blocks are inclined to conform to and be engaged by the adjacent inclined sides of the studs d, so that the blocks are securely held in place.

The blocks h rest upon a yielding support interposed between their inner ends and the bottom of the rim, thereby giving additional elasticity to the tire. This yielding support in Figs.

1 and 2 consists of a stout flat spring-metal band or hoop D, located in the channel of the rim above its bottom and immediately below the transverse portions or studs d and filling the space between the sides of the rim. This hoop is preferable of such a diameter as to normally engage the inner edges e of the studs d throughout its entire circumference, and tends at all times to maintain the blocks h in their projected position and in engagement with the overhanging sides of said studs; but as the blocks are compressed by contact with the ground the spring yields more or less, according to circumstances, and thus in effect increases the cushioning action of the blocks.

In the modification shown in Fig. 3 the rim consists of a single piece of metal, and the transverse wedge-shaped studs or pieces d are independent thereof and are adapted to be detachably secured in place between the sides c c by the bolts g. In this instance also the yielding support for the blocks h of the tire is shown as consisting of an air-cushion E, which when fully inflated completely fills the channel of the rim below the pieces d and effectually maintains the blocks in position.

If any of the blocks h of the tire should become worn or injured they may be readily removed and replaced by new ones. Thus in the construction illustrated in Figs. 1 and 2 by withdrawing the bolts g the sections of the rim may be easily separated and any one or more of the blocks detached from between the studs d, when other blocks may be substituted. In the form shown in Fig. 3 the blocks may be detached by simply removing the intermediate wedge-shaped pieces d.

As the blocks completely fill the pockets occupied by them, and when in contact with the ground are compressed and spread laterally into closer engagement with the walls of the pockets, there is said to be no danger of water or dirt working in behind the blocks.

MINOR MENTION.

The Providence *Journal* is using a gasolene tricycle for the delivery of papers.

Petroleum tricycles of the De Dion pattern will be much in evidence at Newport this summer.

R. O. Hood, Danvers, Mass., is building a steam carriage, the engine weighing 35 lbs. and the boiler 95 lbs.

J. W. Stringer, Marion, O., has completed an electric carriage and is now engaged upon a gasolene motor.

The Frantz Body Mfg. Co., Akron, O., which is making bodies for motor vehicles, is said to be preparing to manufacture motor vehicles complete.

The Union Electric Co., Portland, Me., has been organized to manufacture electric devices and motor vehicles under the patents of L. F. Jordan, a local electrician.

The St. Louis Terminal Railroad Association has decided to put on a line of motor omnibuses to be run from the leading hotels and public places over the Eads bridge to connect with the street railway lines of East St. Louis.

The Niagara Automobile Co., of Niagara Falls, N. Y., has been formed with \$10,000 capital. The incorporators are: P. F. King, Lockport, N. Y., and John H. Leggett, Mrs. Elmer Z. Burns, Marcus Brown and James F. Murphy, of Niagara Falls.

The Duryea Wagon Co., of Springfield, Mass., organized under Maine laws, reports D. A. Reed as president and treasurer; capital \$100,000, all paid in. Assets: Cash and debts receivable, \$3000; stock in process, \$1,500; patent rights, \$48,000; balance profit and loss, \$63,538.72; total, \$116,038.72. Its liabilities are \$16,038.72 debts and the capital.

COMMUNICATIONS.

Hydraulic Checking Device.

LYNN, Mass., June 10, 1899.

Editor HORSELESS AGE:

In reply to a communication in your valuable paper of June 7, headed "Something About Steering Mechanism," will say that the General Electric Co. have considered this subject as important at the outset and have embodied it in an electric carriage constructed several years ago, a description of which appeared in your paper of September, 1898. Therein you will find a paragraph devoted to a hydraulic checking device which does all that "Interested" expects. The writer has driven the carriage over the roughest kind of roads at maximum speed with his hands off the steering handle, or on it as the case may be, without the slightest fatigue or ever coming to grief by result of striking any obstacle on the road. Having run with the same carriage with the device removed, half an hour's ride was sufficient to thoroughly demonstrate the physical and mental strain caused by the absence of it, so well described by "Interested." The device used is one which has a large number of mechanical equivalents containing ratchets, clutches, etc., all with the same object in view, but the form used is found the most reliable of all. It can be used equally well on any kind of carriage, as it does not require any power to operate it, the force which it is to provide against furnishing its own check. There is no doubt in the writer's mind that as the number of carriages increases the public will demand such a device, and already one prominent concern in France has done so.

ENGINEER.

Wants More Road Lessons.

HARTFORD, Conn., June 9, 1899.

Editor HORSELESS AGE:

By all means if you have space let Mr. La Roche give particulars of his trip mentioned on page 19 of your valuable issue of June 7. Facts are what we fellows who are about to buy motor wagons wish to know. Give us facts—all about weight of vehicle, speed, distance, casualties, cost of trip, grades, power, amount of gasoline used, etc., etc. There is no magazine to which I turn with so much alacrity as to the AGE.

Yours truly,

JOHN A. STOUGHTON.

Explosive Motor Exhaust Muffler.

PITTSBURG, June 12, 1899.

Editor HORSELESS AGE:

The high initial pressure at which the waste products of the modern reciprocating explosive engine are exhausted or expanded into the atmosphere has been a fruitful source of annoyance which manufacturers of such engines have not yet entirely overcome. For engines in which a stream of waste water is not available to mingle with the exhaust in the form of a spray the writer has found the following method very effective and easily applied, and while no novelty is claimed for it, this form of construction does not seem to be generally known. The atmospheric end of the exhaust pipe is slotted or cut in a longitudinal direction for a distance of about 14 inches, the slot being simply a saw cut at the beginning and gradually widening until it is an inch or more in width at the

outer end of the slot. I prefer using four of these slots, although two are often all that is necessary to effect a satisfactory muffling of the exhaust. The V-shaped slots in the pipe appear to gradually relieve the excessive pressure of the exhaust before it is finally discharged and the exhaust then resembles in sound that of a steam engine.

Yours truly,

JAMES W. TYGARD.

Width of Tread.

GLASGOW, Pa., June 7, 1899.

Editor HORSELESS AGE:

I am aware of the fact that anything on the subject of horselessness coming from Mr. Duryea or Mr. Winton carries weight. Yet some of us who know comparatively little may hit the nail on the head sometimes.

The subject of width of track is one which is of the utmost importance. First, the different width of tracks in the country. Here for instance, we have 4 ft. 8 and 5 ft., and sometimes in spring and fall roads rut badly, at which time a narrow track rig often squeezes into a wide rut and "does up" a set of wheels in a few moments and vice versa with a wide track rig and narrow ruts.

I find by experience with light rigs that a 4 ft. or less is best. Because a short axle does not spring so much I can keep out of ruts better and it runs in the horse track in winter. I think all this applies to horseless rigs too. Then comes the subject of storage on the road and at home, for on the road the gauge ought to be narrow enough to go into the ordinary double store or into a stall in a stable, which is usually 4 ft. 6 in.

Then in passing on the road in narrow places track cuts quite a figure.

I am of the opinion that a narrow rig (3 ft. 10 in.) would be the thing.

Now, as to turning with a very narrow rig, the short turn can be applied.

A CRANK ON WHEELS.

To Prevent Incrustation of Boilers.

CHICAGO, June 7, 1899.

Editor HORSELESS AGE:

I have read with interest in the columns of your paper the opinions of manufacturers of steam vehicles regarding the scaling of their boilers and I think it quite safe to predict that when their vehicles come west, and the hard water we have here is used in their boilers they will learn a thing or two: namely, that it is an absolute necessity to use some agent to free the water of lime.

I have ordered a steam carriage, which has caused me to seek some means of preventing boiler scale, and have found that 2 oz. of oxalate of ammonia dissolved, say in a quart of water and thoroughly mixed in a barrel of 52 gals. will precipitate the lime, after which the water may be drawn off as it is wanted and used without any danger of incrustation in the boiler.

Tri-sodium phosphate is another excellent agent to purify hard water for boiler use.

I send you these lines thinking perhaps they may interest you and possibly save some of the users of steam vehicles from burning out their boilers. Enclosed please find \$2.00 for one year's subscription.

Yours truly,

M. B. PINZ.

MACHINERY and TOOLS *for motor vehicle builders*

Readers using information from this department are requested to give credit

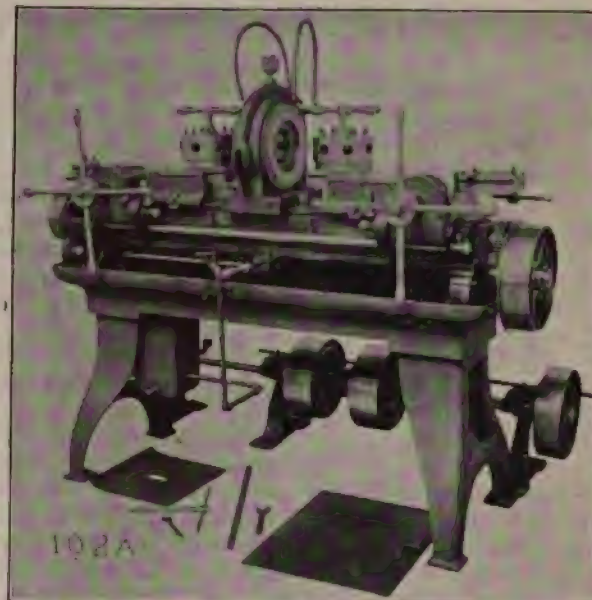
Two Special Garvin Machines.

With characteristic foresight the Garvin Machine Co., of New York, began to prepare for the motor vehicle industry about a year ago. From their extensive experience in the bicycle business they knew well the types of machine tools which would be required by manufacturers in this new line, and now have ready for the market several special machines precisely adapted to this work. Among these are their No. 14 turret machine and the double turret screw machine illustrated here.

THE NO. 14 TURRET MACHINE.

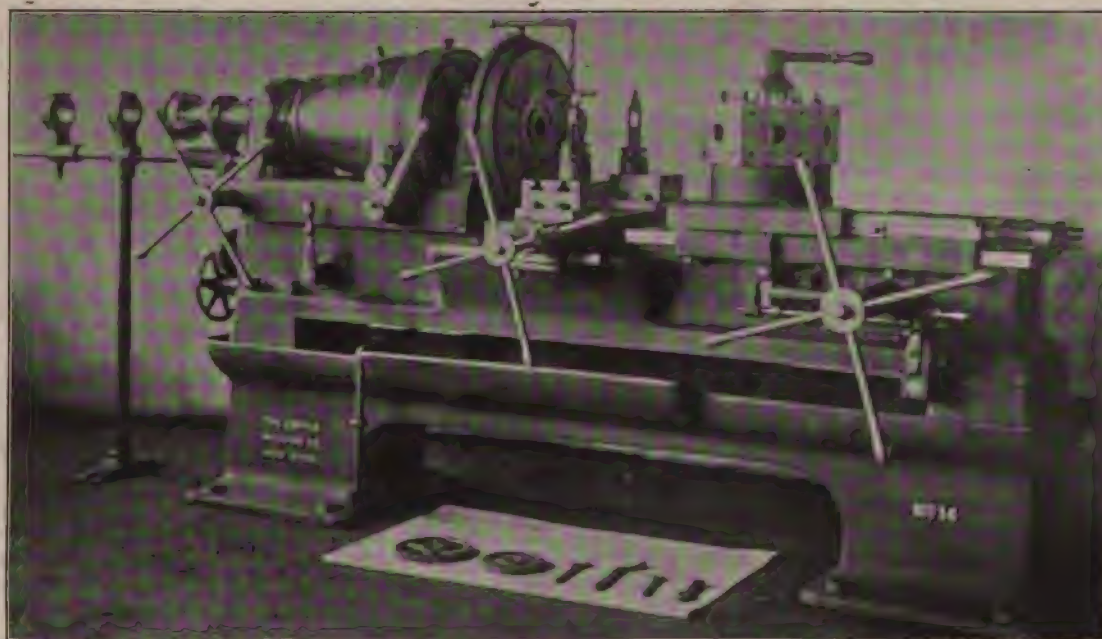
The No. 14 turret machine is a new type of tool designed for motor carriage work, being larger than similar tools of this class, and is built specially for finishing gear wheels, balance wheels, flanges and pulleys. It is equipped complete with a set of universal tools, including automatic opening die heads and collapsible taps, the tools being so arranged that the boring, facing and turning can be done at the same time. The spindle is arranged with an automatic stock-feeding device, taking bars up to 2½-inch diameter and with the collet thrust removed a bar 3¼-inch diameter can be passed through the spindle held in a chuck. The turret is so arranged that a bar of stock can be turned 2 inches in diameter by 24 inches in length. The adjustable box tool will turn a piece 3 inches in diameter by 5 inches in length. Thus all such pieces

as cups, cones and nuts can be turned quickly from the bar. The head stock is powerfully built, and is provided with a back-gear friction head, giving the necessary fast and slow speeds by the simple movement of the lever. The head proper is geared at the ratio of 8 to 1, and the face plate is also provided with shift gear giving a ratio of 14 to 1,



DOUBLE TURRET SCREW MACHINE.

which will supply ample power for turning out large cast steel gears and similar work. The power feed to the turret is supplied with numerous changes of feed and the three speed friction countershaft, in combination with the geared friction head, will give the machine twenty-four changes of speed. The turret is made hexagonal, leaving ample surface for bolting on the



NO. 14 TURRET MACHINE.

tools and special fixtures of various character. An adjustable stop and trip is provided for each separate tool in the turret. The cross slide is arranged with adjustable tool blocks so that they can be set for turning any diameter, as well as being capable of lateral adjustment. The gap in the bed allows a swing for finishing work 30 inches in diameter. A large range of feeds by change gears is provided so that an accurate lead for screw cutting can be maintained when the die is fed upon the work without losing or gaining on the pitch. The second set of gears provides proper feeds, and by means of a handle in the head stock the feed can instantly be changed to regular screw cutting or vice versa. The collet chuck and wire feed is operated by a pilot wheel.

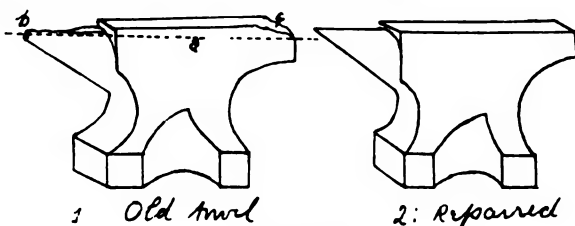
DOUBLE TURRET SCREW MACHINE.

The above illustrates a new type of tool designed for operating simultaneously on both ends of the work, such as wheel hubs, axles, sleeves and similar parts. A great saving is effected by the use of this type of machine, for the reason that the work is only handled once, and the error from re-handling is thus avoided. Both ends being turned and faced at the same time, are necessarily true with each other, and likewise the inner end bearings will also be made parallel. The machine is provided with reversing motion so that right and left hand threads may be cut, and is fitted with a special set of tools, including automatic opening die head and collapsible taps. The central chuck, in which the work is held by right and left-hand screw operating jaws, is provided with anti-friction bearings, thoroughly protected from chips and dirt. The tool-carrying turrets on either side of machine can be operated either independently or simultaneously, and are provided with several changes of power feed.

Motor Vehicle Repair Shop.

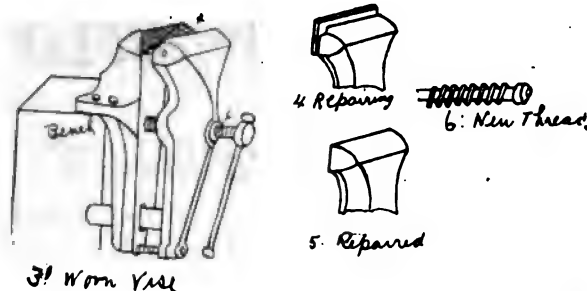
REPAIRING.

A motor vehicle repairer cannot do good work with poor tool. Tools that are worn can frequently be made good as new. Take the shop anvil for illustration. If the corners are broken or worn as at (c), Fig. 1, you cannot draw down any work correctly. If the point is broken as at (b) the anvil is a bother. A new anvil costs several dollars. The old one can be re-ground to the line (a) by an anvil maker at a cost of less than a dollar. This will square the corners and give opportunity to round off the point, making the anvil practically as good as new, as in Fig. 2. Retempering the anvil will improve it. Have the hardy hole upset and forged out again.



THE VISE.

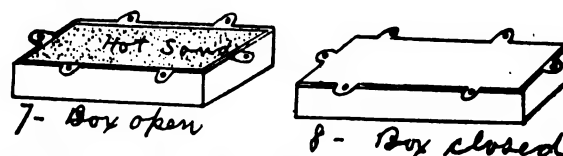
Frequently parts of motor vehicles are abraded and much defective work done owing to a vise being in poor condition. The corners of the vise may be broken off as at (a) and (b), Fig. 3, or the thread in the sheath may be gone. The jaws can be fixed by taking the vise apart and welding on pieces of forged steel, as in Fig. 4. To do this well, heat the jaws high and the piece low and use borax and plenty of hammering



when welding. Then square off the corners, finish, and you have virtually a new jaw piece for the vise, as in Fig. 5. To replace a worn or broken thread in the sheath, heat and remove the old thread and wind on some steel wire of right size as in Fig. 6, turn this into the old sheath so as to get the thread adjustment right, remove and braze the wire on.

CARE OF DIES.

Either machine or hand plate dies for cutting or cleaning threads on the bolts and shoulder pieces of parts of motor vehicles must be kept in good condition, if good work is wanted. Dies become dull in time and tear the thread and sometimes twist off the smaller bolts. To sharpen dies, such as are used for ordinary motor vehicle work, first draw the temper. This can be done by heating and placing in sand for about ten hours. Better results are obtained by using a cast iron box, which can be bought for a small sum at any iron foundry, No. 7. The dies should be burned in the sand and the cover put on as in No. 8.



Previous to putting the dies in the sand, heat them red. Also heat the sand. Then after the box is made up, allow the whole to cool over night. The dies will be found right to handle in the morning. The threads may be renewed by turning the dies on the tops. Next the temper must be restored, which can be done by coating the threads with rye meal mixed with water, then heating the dies to dull red and hardening by cooling in water. The meal paste protects the fine edges of the threads from burning in the intense heat. Dies threaded as above will be about as good as new.

How the Dusky Cabbies of Atlanta View It.

This innovation for the traveling public is causing wild discontent among the local cabbies. They are actually afraid that the electric competition might injure their business, and are putting up all sorts of arguments against "auter-mobules," as they call them. One dusky driver, who has been following a skinny horse in Atlanta for years, advanced the argument last night that Atlanta's streets were entirely too narrow for the horseless cabs, which collided every hour, he said, on Broadway and Fifth avenue. Another claimed the automobiles were dangerous in thunderstorms, and still another claimed these turn-crank vehicles were worse than horses for running away. —Atlanta Constitution.

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 626,440—Motor-Bicycle—Joseph F. Raders, New York, N. Y., assignor, by direct and mesne assignments, of one-half to Edward N. Dickerson, same place. Application filed February 17, 1896.

It is the intention in the operation of this invention to make use of the jolting movements of the rider to effect a compression of air and its storage in the reservoir B. Provision is also made by which additional compression and storage may be derived from the surplus energy developed by the bicycle—as, for instance, while it is descending an incline. Air thus compressed and under the control of the rider may be led from the reservoir and serve as the motive fluid in a suitable device in operative connection with the driving-wheel of the bicycle, and thus be added to the effort exerted by the rider.

The cylinders A1, A2, and A3, are conveniently secured to rings a1 a2 and the connected parts rigidly attached to the reservoir B or directly to the frame A. The cylinders are single-acting and provided with trunk-pistons A4, from each of which extends a connecting rod a3, taking hold of a crank-pin a4 at the opposite end. The crank serves to rotate a shaft C, mounted in suitable bearings and provided with a sprocket-wheel c, connecting with the ordinary pedal crank-shaft C1 by a chain and sprocket-wheel connection c1. Suitable passageways extend from the outer end of each of the cylinders A1 A2 A3 to a valve casing or chest D1, through the walls of which they pass by ports d. The valve D2, controlling the movement of the air to and from the cylinders, is rigidly se-

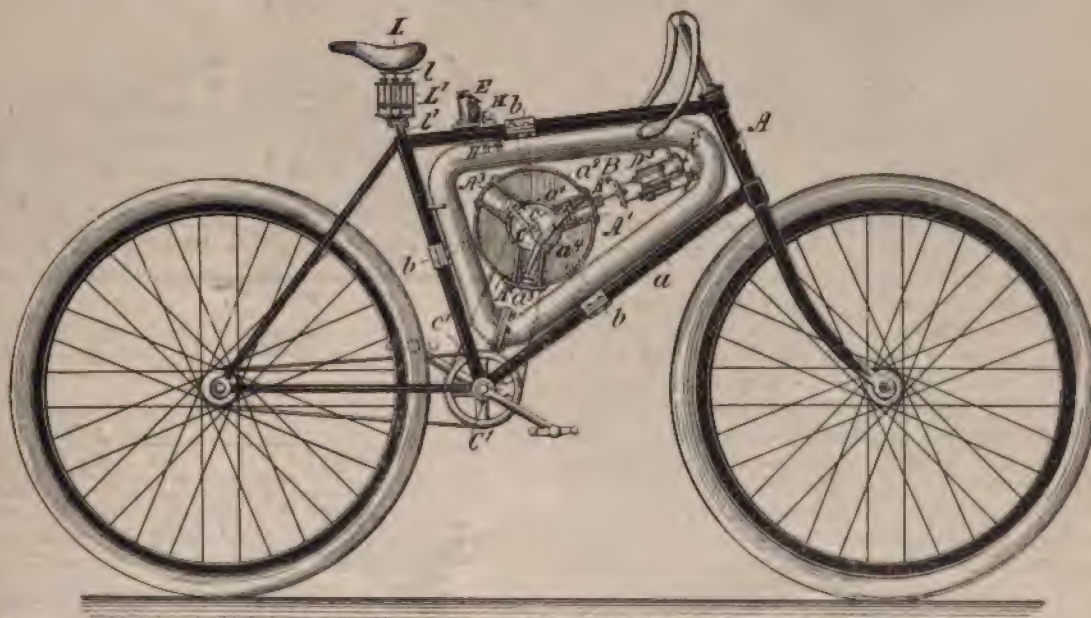
cured to the shaft C and works in the casing D1. It is provided with a short port d1 and a long port d2, extending around the periphery of the valve, the former of which serves as an air-inlet to the several cylinders and the latter performing the functions of an exhaust-outlet. The two ports or openings d1 and d2 in the valve are separated from each other by a partition d3, which divides the interior of the valve into two chambers. The casing D1 is provided with end plates d4, completely inclosing these chambers, and to their respective chambers the inlet and exhaust pipes D3 D4 are affixed.

D5 is an air compressor or pump, operated from a piston of one of the aforesaid cylinders and serving to force air into the reservoir B when the bicycle is running freely of itself and developing surplus energy which it is desired to store.

I have also adapted the cylinders A1 A2 A3 to be used as compressors when desirable to store air in the reservoir B, so constructing the apparatus that either one, two, or all three of the cylinders may be used. To this end, instead of extending the passageways directly from a cylinder to the valve-casing D1, conduits are extended connecting with the casing and with the cylinder end to a plug-valve E, to the casing of which latter the ends of the conduits are rigidly secured. Suitable recesses are provided in the body of the valve, connecting the proper conduits or pipes with each other. These recesses are of such size and arrangement as to successively cut off communication between the cylinders and main supply-valve upon the shaft during the rotation of the plug-valve. The pipes leading from the valve E to the cylinder A1 and to the valve-casing D1 are marked e e1. Those for the cylinder A2 are marked e2 e3, and those for the cylinder A3 are marked e4 e5.

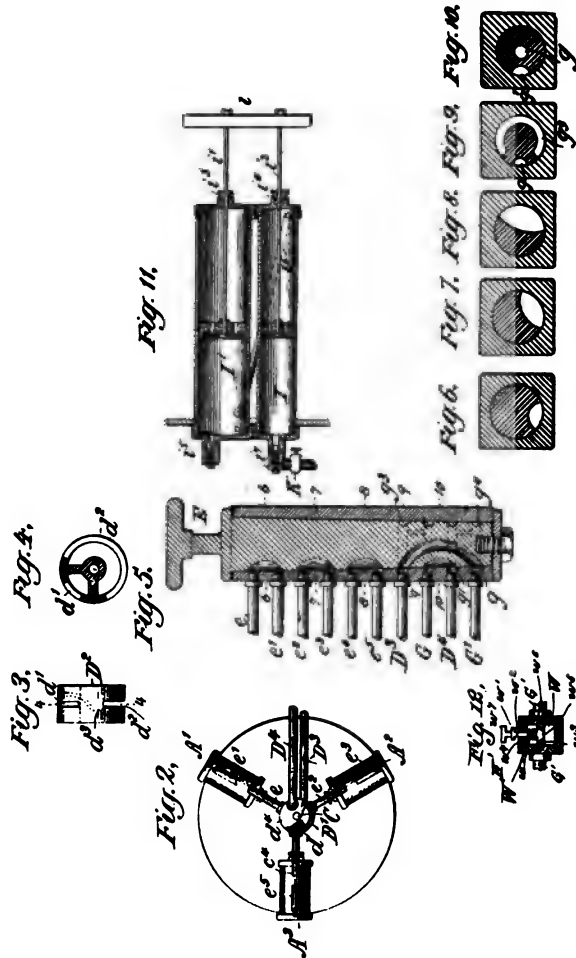
To convert the three cylinders A1 A2 A3 into compressors, it is necessary that the passageway which ordinarily serves to receive air from the reservoir B should be open to the atmosphere and that opening which ordinarily forms the exhaust of the engine or is open to the atmosphere should be connected with the reservoir. The inlet and exhaust pipes D3 D4 extend from the valve-casing D1 aforesaid to the valve E, to the casing of which they, as well as pipes C C1, leading, respectively,

Fig. 1.



MOTOR BICYCLE OF JOSEPH F. RADERS, NEW YORK.

to the atmosphere and from reservoir B, are secured. Normally or while the cylinders are acting as engines to propel the machine a recess g in the body of the valve places the pipe C1, leading from the reservoir, in communication with the pipe D3, leading to the inlet to the cylinders, and an independent opening g1 places the pipe D4, leading from the exhaust side of valve D2, in communication with the air-outlet G. When, however, the valve E, which may be located at any convenient point on the bicycle, is given a slight turn, pipes D3 G are placed in communication by peripheral recesses and cross-con-



nection g3, and pipes G1 and D4 are also placed in communication by similar recesses g4, thus converting the cylinders into compressors. This connection is maintained during subsequent rotation of the valve, which successively cuts out cylinders A1 A2 A3 until it again returns to its normal position. The pipe G1, leading to the reservoir, may be provided with a stop-valve H1, and a check-valve H1 is also provided, which is so constructed that it may be thrown into operative position when compression from one or more cylinders is taking place, but may be rendered inoperative when the cylinders are acting to propel the machine. A construction accomplishing this end is shown in Fig. 12, in which two chambers W W1 are formed in the valve-body, the partition w3 between the two chambers being provided with a valve-seat for the valve w5. The portion of the pipe G1 between the reservoir B and valve H1 communicates with chamber W1 above the valve through port w6, while the portion of the pipe between the valve H1 and valve E communicates with the chamber W below the valve through

port w. The spring w4 embraces the valve-stem w7, urging the valve to its seat. When it is desired that the valve shall be held away from its seat, there is provided a boss or projection w1 upon the valve-stem, which when the latter is turned contacts with the boss w2 upon the top of the valve-casing and by riding up upon the same causes the stem and valve to be elevated and held in this elevated position.

The pump D5 comprises a cylinder I of relatively small diameter and one or more cylinders I1 of larger diameter. The pistons of these cylinders are connected by a crosshead i, attached to piston rods i1 i2, passing through stuffing boxes i3 i4 in the ends of the cylinders I I1. The larger cylinder I1 is provided with a valve-controlled air inlet i5, while its outlet is through a valve-controlled conduit i6, extending from near the bottom of the cylinder to near the top of the smaller cylinder I. The piston of this latter cylinder is provided with the valve Z, permitting air to flow from one end of the cylinder to the other and finally discharge into the air reservoir B through a suitable valve-controlled passageway i7. The pump is provided with suitable means for rendering it inoperative. For instance, a valve K may be provided, throwing the discharge into the atmosphere when properly positioned.

It is also a feature of the invention to utilize the jolting movements of the rider as a means for further compressing air into the reservoir. For this purpose is secured the saddle L to the cross-head l of an air compression pump, which discharges through a suitable valve-controlled passageway l1 into the reservoir B.

No. 626,294—Self-Propelled Vehicle—Edward Joel Pennington, Coventry, England. Application filed October 23, 1896.

This invention relates preferably to three-wheeled vehicles. In the drawings, Fig. 1 is a side elevation, and Fig. 2 is a plan, of the vehicle.

The framework is tubular and comprises two inclined longitudinal tubes A, bound together where necessary by cross frames or connections A1 and carrying at the front end a cross-tube A2, which forms another cross connection between the two tubes A and supports the steering-heads B for two steering-wheels C C1, each carried in its appropriate fork B1,

Fig. 1

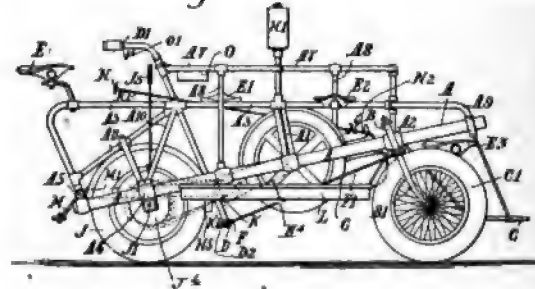
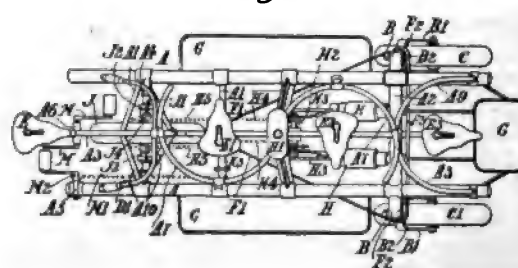


Fig. 2



The steering is effected from the back by a steering-rod D, pivoted in the framing and provided with a handle-bar D1, to be controlled by the rear rider, who sits upon the saddle E. At the lower end of the rod D is a chain-wheel D2, around which passes a short length of pitch-chain F, connected by rods F1 to similar short lengths F2 of pitch-chain, which gear with sprocket-wheels B2, fixed upon the stems of the forks B1, a rod F3 being employed to connect the two portions of chain at F2 at the opposite sides of the machine, so that the three chain-wheels D2 B2 B2 are geared together by the endless connection F F1 F2 F3 under the control of the steering handle-bar D1, whereby the forks are movable to turn the wheels C C1 by which the vehicle is steered. The saddle E is carried on a central tube or frame A3, which carries also other seats or saddles E1 E2 E3, the first and last being by preference so arranged that the persons using those seats sit facing forward, though the persons using the other seats face sidewise.

For the feet of the riders foot-boards G, rests, or equivalents are provided. The person who uses the rear saddle E, which is raised higher than the others, is intended to have control of the vehicle. All the necessary handles for starting, regulating, steering, braking, and generally controlling the vehicle are arranged in proximity to that saddle.

H are the cylinders of the motor, which preferably should be an explosion-engine of the well-known Pennington type. They are carried by the cross-tube A2 and supplied with oil from a reservoir H1, fixed on the framing.

H2 is the driving-shaft of the motor which is geared through intermediate gearing, hereinafter described, to the gear road-wheel or driving-wheel J, the shaft J1 of which is journaled in bearings A4, fixed to the main tubes A of the frame.

H3 are connecting-rods by which the movement of the pistons of the motor-cylinders is converted into rotary motion of the shaft H2, and H4 are pitch-chains, whereby the motor-shaft H2 is geared to intermediate sprocket-wheels K, Fig. 1, carried upon a sleeve K3, Fig. 2, which is rotatable upon the rearmost one of the stays A1. Upon this sleeve are fixed another pair of sprocket-wheels K1, which are geared by pitch-chains H5 to other sprocket-wheels J4, rotatable about the shaft J1. The two sprocket-wheels J4 are of different sizes, so that when driven by the motor they will turn at different speeds, either one of them at a time being coupled to the road-wheel J by means of clutches J2 (indicated in Fig. 2) and controlled by levers, such as J3, Fig. 1, which preferably should be so arranged that when one clutch is in gear the other is out of gear. Thus the speed of the road-wheel J in relation to the speed of the motor depends upon which of the two sprocket-wheels J4 is caused by the clutches to engage with the road-wheel. The proportions of this chain-gearing are such that the angular velocity of the driven wheel J is considerably less than that of the motor crank-shaft H2.

H6 is a fly-wheel fixed on the shaft H2.

N is a handle controlling a rod N1, connected to a valve at N2, whereby admission of oil to the motor-cylinders is regulated.

O is an electric battery, and O1 a switch-carrier on the handle D1 to control the current led from the battery to the igniter of the motor.

Instead of explosive-engines any other suitable type of motor can be employed, operating directly or through the medium of any desired type of gearing upon the driven road-wheel J.

Beneath each side of the side foot-boards G is a quieting-chamber L, Fig. 1, of any suitable construction, into which the exhaust-gases from the motor-cylinders H are delivered. The

heat given up by these gases in the quieting-chambers serves to warm the side foot-boards G.

It is convenient, especially where explosion-engines are employed to drive the vehicle, that cycle-cranks, such as M, should be provided and geared, as by the chain M1, to the sleeve K3, as shown, which carries the intermediate gear K K1. The said sleeve K3 encircles the stay A1, having fixed upon it the intermediate chain-wheel K K1, hereinbefore referred to, and also a chain-wheel concealed by the chain M1 in the drawings, which by the said chain is connected to a similar but smaller chain-wheel on the crank-shaft M2 of the cranks M, which is supported in a bearing A5 upon one of the frame-tubes A and a bearing A6 on the frame-tube A3. The cranks M are under the control of the person seated on the saddle E and constitute a starting-gear for the vehicle and also a foot-rest for the rider in that saddle. Instead of being geared to the intermediate shaft the cranks could be geared to the motor-shaft or to any one or more road-wheels of the vehicle.

A7 is a reversely-curved stay-tube of two circular bends, the center of each bend being in the seat or saddle placed within it and the stay-tube serving as a back or rest for the rider in that seat.

A8 are supporting tubes by which the curved stay is connected with the main tubes A of the frame. It will be seen that at the front end of the vehicle the tube A3 is connected to a similar curved tube A9, forming a rest for the rider, who occupies the front seat E3. Thus the framing is in three tiers, the lowest tier being constituted by the main tubes A, the middle tier by the tubes A3 A9, and the top tier by the tube A7.

A10 are struts supporting a tube A11, which extends across the angle formed by the downward bend at the rear end of the tube A3.

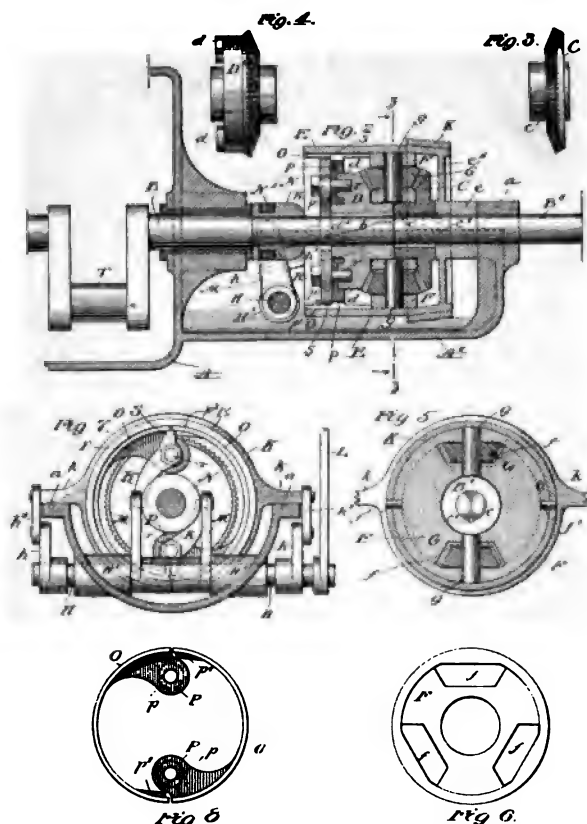
The cycle-cranks M will be connected with the part to be driven by ratchet or friction or other clutch mechanism, so arranged that if the rider works faster than the other shaft he will exert power to propel the vehicle or rotate the engine-shaft, but when the engine-shaft runs away the cycle-shaft will be left and need not operate. Preferably this action is automatic, as in the case of a ratchet or similar clutch; but ordinary friction or grip clutches may be employed, if preferred.

No. 626,395—Reversing-Gear—Carl C. Riotte, New York, N. Y. Application filed May 9, 1898.

In the construction shown, A is a broken-away view of part of the engine-casing or any other suitable support. A1 is a drip-pan, preferably attached thereto and supporting in suitable journals the driving-shaft B. This shaft is divided into two parts B and B1, as shown at b, and is driven by an engine, as at T, in any manner desired. The beveled gear-wheel D is keyed, as shown at d1, or otherwise fastened to the part B. To the part B1 is fastened by a key c1 or otherwise a beveled gear-wheel C, which has an extension c on the shaft.

E is a revoluble part, preferably in the form of a frame or casing to protect the mechanism, having a head e1 and a hub e fitting loosely on the shaft B1, so that the shaft may rotate independently of this casing.

F is a transverse head, preferably of circular form and fitting the interior of the casing, to which it is attached by the pins f1. This head F has a plurality of perforations f, as shown in Figs. 5 and 6, and in such perforations are inserted the beveled gears G, pivotally held in place by the pins g and which mesh with the gear-wheels C and D. It will be observed that the extension c on the gear-wheel C, and the corresponding extension on gear-wheel D enter a circular recess in the head F, and those parts of the head F and of said two gear-wheels which lie in vertical contact with the head F, as shown



in Fig. 2, bear against each other, and as these gears are fixed to the shafts the head at these points takes up the end thrust of these shafts. Furthermore, in this construction the shafts are kept in alinement and partially supported at their ends by the extension *c* on gear-wheel *C* and the corresponding extension on gear-wheel *D* entering and fitting the circular hole in the transverse head *F*.

K is a clutch for holding from rotation or releasing the frame or casing *E*.

H is a rock-shaft actuated by a lever *L* and passing through journals *H*₁ on the drip-pan and carrying arms *h* rigidly fastened to it. The clutch *K* in this embodiment of my invention is preferably in the form of a rigid ring, as shown, and has lateral extensions *k*, which slide upon guideways *a* on the drip-pan. Links *h*₁ are pivotally connected to these lateral extensions and also to the arms *h*, so as to throw the clutch *K* into and out of engagement with the casing *E* when the lever *L* is operated.

The gear-wheel *D* has lugs *d* projecting from one face of it.

O *O* constitute a second frictional clutch, preferably in the form of a split spring-ring, each section of which has an ear *P* and a lug *p*₁. The ears *P* have recesses in them, which enable them to be fitted over and slightly rock upon the projections *d*, and they are movably held in place by pins *r*. The ring when in place is preferably of a size which just fits within the casing *E*.

R *R* are levers pivoted upon the pins *r* and having projections *S* *S* adapted to engage the lugs *p* *p*₁ when said arms are thrown outward.

N is a cam for operating the arms *R*, loosely mounted on the shaft *B*, so that it may be slid longitudinally thereon, and preferably having a groove *n*, in which is a collar *N*₁.

M are levers fixed on the rocking rod *H* and engaging trunnions on the collar *N*₁, as shown, to operate the cam.

When the parts are in the position shown in Figs. 1 and 2, the clutch *K* engages the casing *E* and prevents the same from rotating. The beveled wheel *D* rotates with the shaft *B* and communicates a rotary motion through the beveled gears *G* *G* to the gear-wheel *C*. The wheel *C* is fixed to the shaft *B*₁, and said wheel and shaft will therefore be rotated at this time in the opposite direction from that of the wheel *D* and shaft *B*. If now it is desired to reverse the shaft *B*₁, it is only necessary to throw over the lever *L*, which will rock the shaft *H* and arms *M* and *h*, throwing the clutch *K* out of engagement with the casing *E*, and throwing the cam *N* into engagement with the arms *R*. As the arms *R* are engaged and moved by the cam, the projections *S* will be moved in the opposite direction and will engage the lugs *p*₁ *p*₁, and the diameter of the clutch will be increased as the parts *O* *O* are outwardly bent and will engage the inner surface of the casing *E*, which will then be carried along by the wheel *D*. As the beveled gears *G* are fixed relatively to the casing *E*, no rotary motion around their pivots can be given them as long as the clutch *O* tightly engages the casing *E*, and as they at all times mesh with the gear-wheel *C* said gear-wheel will be carried on in the same direction of rotation as that of the wheel *D*, thus reversing its former rotation.

By this construction the shaft *B*₁ may be quickly rotated in either direction by a mere movement of the lever *L* without any sudden shock or jar, as the clutches will come into action gradually, and therefore the cogs of the gear-wheels are not liable to become stripped or the parts in any way injured. The speed of the shaft *B*₁ in either direction may be regulated by the intermediate positions of the two clutches, and when both clutches are out of engagement with the casing *E* the casing or gears, or both, will idly rotate and communicate no movement to the shaft *B*₁. All movements of the shaft, either in speed or direction, may therefore be accurately controlled by the manipulation of the lever *L*.

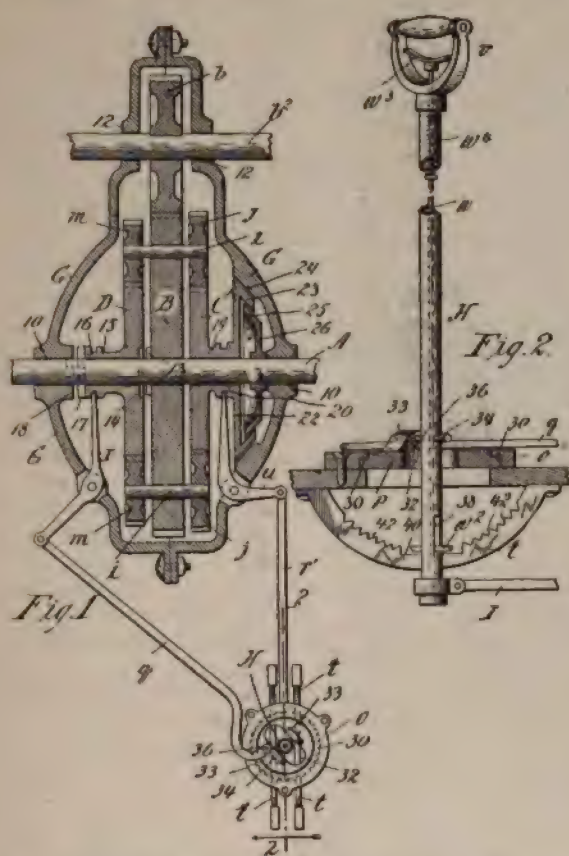
No. 626,445—Variable Speed Gearing—Hinsdale Smith, Springfield, Mass. Application filed March 14, 1899.

This gearing is said to be especially available for use in motor-propelled vehicles and launches.

The object is to provide a variable-speed gearing of the class indicated which is even simpler than that applied for by the same inventor July 6, 1898.

The invention consists, primarily, in a speed-gearing, of the combination of a shaft mounted for rotation, a main or carrier wheel mounted and freely rotatable upon and relatively to said shaft, a planet-axle carried by said main wheel parallel with said shaft, a pair of united planet-wheels on said planet-axle, a gear on said shaft meshing with one of said planet-wheels and means for locking said gear to the shaft, another gear loose on said shaft and meshing with the other of said planet-gears, and means for locking the last-named gear temporarily to the shaft or for locking it temporarily against rotation.

Claim.—The combination with the speed gearing, consisting of a fixed support and oppositely-arranged clutch members thereto provided, the shaft *A* mounted for rotation within said support and having the clutch members 13 and 25, a carrier-wheel *B* loosely rotatable on and relative to the shaft and carrying the united planet-wheels *m* and *j*, the gear-wheel *D* adapted to be clutched to said shaft-clutch 13, or to one of the clutches of the stationary support, the gear-wheel *C* and the clutch member 23 thereof adapted to engage either the adjacent shaft-clutch or the fixed support-clutch, clutch-operating connections *q* and *r*, a rotatable plate having the slot 32 to which one of said connections is secured, the handle-bar *H*, pivotally mounted to swing relatively to and through the slot



of said rotatable plate, and the opposing guards between which said handle-lever is extended, and parallel with or angular to which the said slot of the plate may be brought by a rotational movement of the handle-lever.

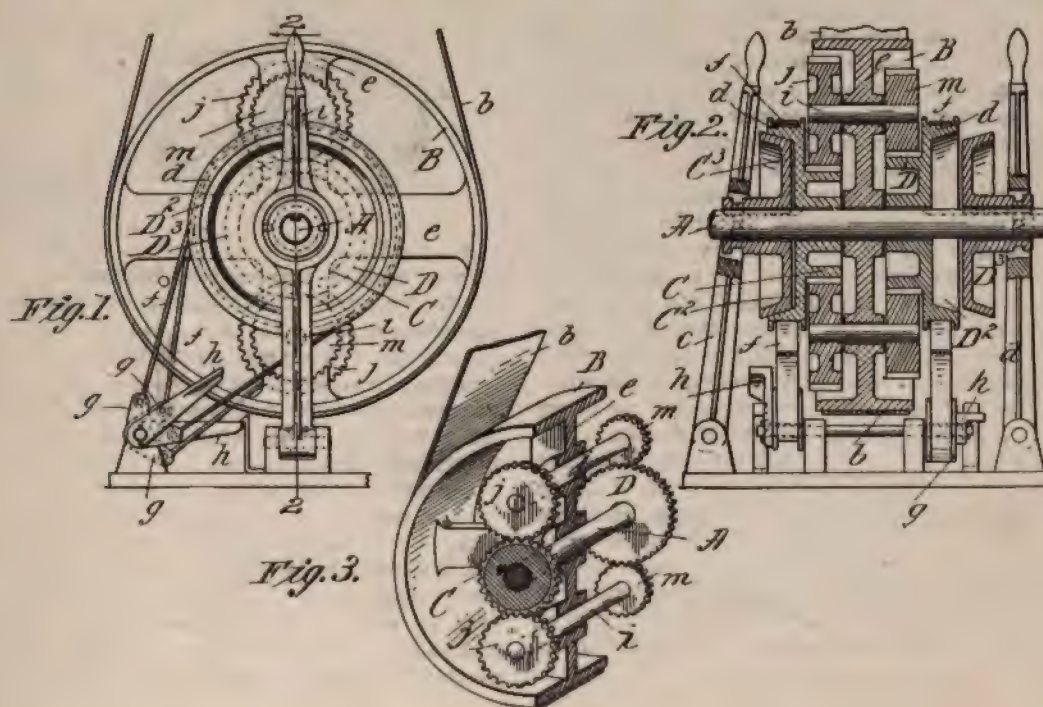
No. 626,444—Variable-Speed Gearing—Hinsdale Smith, Springfield, Mass. Application filed July 6, 1898.

Fig. 1 is an end elevation. Fig. 2 is a central vertical section of the same taken on the line 2 2, Fig. 1. Fig. 3 is a perspective and sectional view designed to show more readily the relative arrangement of the several gears one to the other, and to the driving and driven parts.

A represents a shaft which under the one aspect of this mechanism is to be regarded as the driven part, and B represents a pulley-like wheel loosely mounted to turn about the shaft, constituting the driving part, b indicating a driving belt therefor. The wheel B is constructed with a widened rim and a web or spokes e uniting its hub and said rim.

C and D represent spur gear-wheels of unequal diameters loosely mounted on the shaft A at opposite sides of the wheel B, each having a clutch member C² D² at its outer end, and splined on the shaft outside of each gear-wheel is the clutch member C³ D³, having combined therewith the operating-levers c and d for throwing the sliding splined clutch members into or out of connection with the said gear-wheels, whereby at pleasure each is rendered fast on or loose from the shaft, and the outer portion of each gear-wheel C D is, moreover, constructed with a grooved cylindrical portion d, about which is the respectively provided strap f, the approached ends of each thereof being connected to the arms g g of an angular lever, the location of which is suitably radially distant from the strap-surrounding cylindrical part, and each of these two armed levers is mounted to rock on a journal or pivot shaft and has an operating-lever h, whereby to oscillate it for the purpose of leaving the strap free or of tightening it about the cylindrical portion of the gear-wheel, all in a well-known manner, the strap and its tightener constituting in themselves no invention.

The wheel B carries between its hub and rim the journal-shaft i, the length of which is parallel with the axis of the wheel B, said shaft being bodily revoluble in unison with the said wheel by which it is carried and also independently ro-



tatable on its own axis, and this journal-shaft *i* has fixed on the opposite ends thereof, located at opposite sides of the wheel *B*, the spur gear-wheels *j* and *m* of unequal diameters, the one being in mesh with the gear-wheel *C*, and the other in mesh with the gear-wheel *D*, and both while rotating in unison are also revoluble around on said gears, with which they respectively mesh.

In the drawings the journal-shaft *i* and a spur gear-wheel *j* and *m* are shown duplicated at diametrically opposite locations on the gear-carrying wheel *B*. The provision of the second journal shaft or arbor *i* and the two gear-wheels thereon is by no means a necessity to the operativeness of the mechanism; but these are preferably employed for the purposes of equilibrium, and, again, instead of paired sets of these gear-carrying journals more than two thereof may be employed.

This mechanism referred to in connection with the drawings is capable under different conditions of giving two speed motions, the first in the direction of that of driver *B* only partially as fast, the second, reversed of that of driver, also only partially as fast, and in addition a speed in same direction and at the same speed with the driver. Assuming, as an example, that the gear-wheel *C* is unrestrained by its strap and by the clutch united to the shaft and that the gear-wheel *D* is unclutched from the shaft and by its strap held against being rotated, the rotation of the gear carrier or driver *B*, carrying the gears *j* and *m*, will cause a rotation of the gear *j* in the same direction as that of the rotation of the driver *B*, but with greater frequency of rotation, if the gear *D*, which is restrained, has more teeth than the gear *m*, revolving around and in mesh with it, so that if, for instance, gear *D* has twenty-four teeth and the gear *m* has sixteen teeth a complete revolution of *m* around *D* will cause *m* to be rotated on its own axis one and one-half times in the same direction as it revolves, and the gear-wheel *j*, assumed to have twenty-teeth (which meshes into the equal-sized gear *C*, coupled to the shaft), while it has during one revolution thereof its one and one-half rotations, by reason of also revolving completely around the gear-wheel *C* will cause gear *C* and the shaft to be turned one-half a rotation to every rotation of the driver *B* and in the reverse direction from that of the driver. Assuming, again, that gear *C* is unclutched from the shaft and restrained by its tightened strap against being turned and gear *D* is clutched to the shaft and by its loosened strap left free to turn, it will be found that each revolution of the driver will cause the gear *j*, carried thereby, to be rotated once in the same direction that the driver revolves, and each concurrent rotation of the connected gear *m*, revolving around and in mesh with the gear-wheel *D* of greater diameter in making each complete revolution about said gear, causes that gear and the shaft to be revolved a fraction of a turn equal to the difference between the number of teeth in wheel *m* and the number in gear-wheel *D* and in the same direction—that is to say, with the relative number of gear-teeth mentioned the driver *B* will rotate the shaft in the same direction, but only one-third as fast. By holding one of the strap-surrounded gears and leaving the other unclutched the driver *B* will be without effect in its rotation to turn the shaft. By loosening the straps for both gears and throwing both these gears into the clutch with the shaft the shaft will be driven equally with the driver *B* in the same direction—that is, as one with it—for the two clutches together through the connected gearing lock the wheel to the shaft, and if now one or both of the straps are placed in bind about the cylindrical portions of their respectively adjacent gear-wheels *C* or *D* they may be utilized as brakes to reduce the speed of the mechanism as driven by the belt.

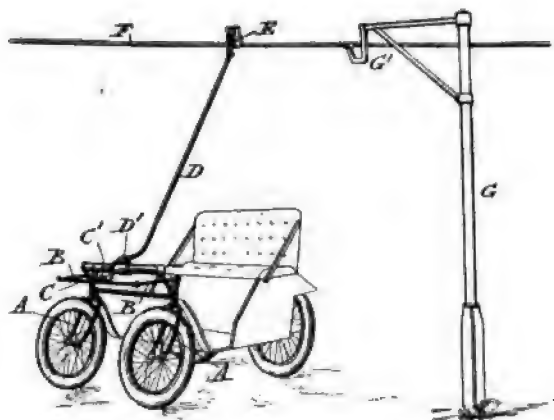
The driving-power may be applied through the shaft *A* and the same speed forward or different speeds, forward or reversed, imparted to the gear-carrying wheel *B*, this obviously being merely a reversal in the manner of using the mechanism which will be more available in some cases, and by changing the relative sizes of the various gear-wheels correspondingly-different relative speeds may be acquired in the driven part from that of the driving part to provide for various requirements, besides retaining the capability of causing the one to be driven in unison with the other.

No. 626,296—Device for Steering Motor-Driven Vehicles—Edward J. Pennington, Walton-upon-Thames, England. Application filed December 30, 1897.

This invention comprises a steering-pulley or the like running on an overhead rail or cable and an arm or other means for connecting the pulley to the steering apparatus on the vehicle, the whole being so constructed and arranged that the lateral movements of the arm or other connector, due to the deviation of the vehicle from its true course, will operate to control the steering apparatus, and so automatically bring the vehicle back to its proper course. The overhead pulley is pushed or drawn on its rail or cable by the vehicle.

Referring to the accompanying drawing, which illustrates in perspective one mode of carrying it into practice, a four-wheeled vehicle driven either by an internal-combustion engine or electric motor, the steering-forks *A A* of the front wheels are furnished with arms *B B*, connected by a link *C*, the lateral movements of which operate to steer the vehicle.

D is an arm pivoted to the vehicle at *D'* and carrying at its upper end a flanged pulley or sheave *E*, which runs upon the



wire or cable *F*, by which the steering is controlled. The wire or cable is supported by brackets *G'*, carried by pillars *G* or otherwise, and constructed so that the pulley *E* can pass them readily. The lower end of the arm *D* is forked and engages with a pin *C'* on the link *C*.

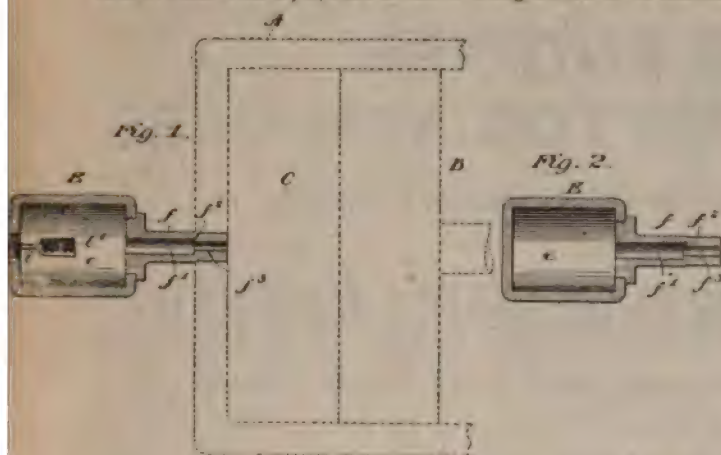
Should the vehicle when traveling on the road deviate from its proper course the arm *D* will operate to move the link *C*, and so turn the steering wheels in such a direction as will instantly bring the vehicle back to its proper course.

The pulley *E* is in some instances arranged underneath the wire or cable, in which case the arm *D* is supported by a spring, which keeps the pulley in contact with the cable.

When applying the improvement to vehicles driven by electricity supplied from a central station through an overhead wire, the arm *D* may be used for making the necessary connection between the overhead wire and the vehicle. A return overhead wire will be used in this case for the return-current.

No. 626,394—Igniter for Gas Engines—Carl C. Riotta, New York, N. Y. Application filed March 29, 1898.

Claim.—In combination a cylinder, and an igniter having a metallic ignition-chamber, a restricted opening therefrom through which gas to be ignited is adapted to be forced in part and to burn with a jet, said chamber being closed in its normal



operation to the egress of gas except through said opening, said igniter located outside of said cylinder and having an electric igniting attachment therein, so as to be away from the direct heat from said combustion-chamber.

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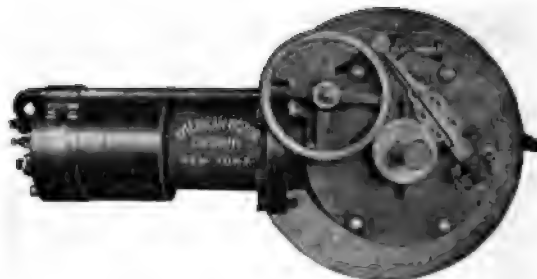
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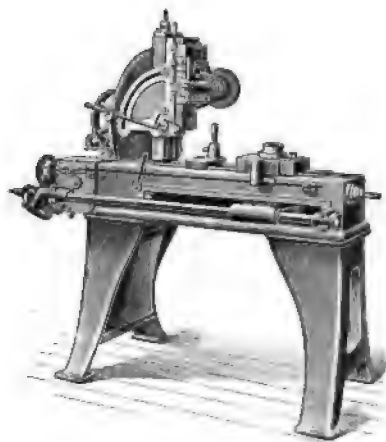
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Vol. IV.

NEW YORK, JUNE 21, 1899.

No. 12.

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Entered at the New York post-office as second class matter.

**On account of the excessive discounts charged
by New York banks on small checks under their
new rule, subscribers are requested to remit by
Post Office or Express money order or N. Y. draft.**

New York-Irvington.

Another New York-Irvington contest is announced and by
virtually the same patron, John Brisben Walker, proprietor of
the *Cosmopolitan Magazine*, and vice president of the new
manufacturing company which now offers a prize.

Mr. Walker's first effort at the promotion of the motor
vehicle did not meet with the response it deserved, owing to
the embryonic state of the industry at that time. It is to be
hoped that a better showing will be made this time, but the
notice—little more than thirty days—is altogether too short,
even though three years have elapsed since the *Cosmopolitan*
race. The number of entries is still likely to prove disappoint-
ing. In practical points of construction, however, substantial
progress will be shown.

The course is well chosen, affording sufficient variety of
road and traffic to fairly test the general utility of a motor
carriage, so far as it can be done apart from actual service in
unskilled hands,

Some parts of the judicial code will bear discussion. Ease
of control and "ease of learning" appear to be so inseparable
as hardly to warrant separate classification. The term safety
needs a narrower definition, as has already been pointed out
in these columns.

Control is all but ignored in this schedule. It receives only
10 points, while speed secures 20, a manifest inconsistency,
for a motor vehicle may be capable of a speed of 40 miles an
hour and yet be impractical for general use, because of the
complexity of its controlling apparatus. In like manner a
vehicle which is easily controlled is easily learned and is also
safer than a complicated one, because it responds more readily
to the will of the driver. Control in a motor vehicle is there-
fore of prime importance, outclassing speed by far and being
intimately associated with simplicity, safety, durability, etc.
In fact, it is the *sine qua non*, without which a motor vehicle
cannot be regarded as practical. It includes stopping, starting,
steering and regulation of speed.

The importance of the next point—ease of obtaining fuel—
depends largely upon the radius of action of the vehicle. If
it is for touring or other rural use, fuel must be obtained with-
out previous arrangement, but for city use this is not at all
essential. However, as the nature of the contest—the distance
and hilly character of the road—excludes electric and other
storage systems, this point may be dismissed as not likely to
cause controversy. Noise and odor are relatively unimportant
for the same reason. Hence criticism centers chiefly around
the point of control and its kindred point, simplicity. This
part of the code, in the writer's estimation, will bear revision.
Durability, too, is somewhat slighted, while hill climbing,
which is a very pretty snectacular effect, it is true, is rather
exaggerated in value for practical purposes.

An encouraging sign is seen in the relative importance
assigned to speed in the code of 1896 and that of 1899. In
the former competition speed was given 35 out of 100 points;
in the present competition it is credited with only 20 out of
the 165 points, proving that high speed and practicability are
becoming dissociated in the public mind. This is further

evidenced by the fact that the former event was called a race by its promoter, and was purely and simply a race from start to finish, even on the city thoroughfares, where a procession had been planned. In this respect the contestants were censurable, and the judges of the present "contest" will do well to have it distinctly understood that the rules touching the progress of the vehicles through the lower part of the city must be observed, and that anyone who disobeys them will forfeit his chance of winning the prize.

When all is said it must be remembered that the contest is necessarily superficial, referring merely to a few types of pleasure carriages, and leaving untouched the great problems connected with the specialization of the motor vehicle, *i. e.*, its adaptation to thousands of different commercial needs, problems which can only be brought out by separate competitions organized on narrower lines.

Prejudice of Livery Stable Keepers.

According to the statement of one of the organizers of the Automobile Club of America, the livery stable keepers of New York City are showing a very stupid hostility to the motor carriage in refusing to entertain any offers for its care and storage. The progress of the motor vehicle cannot possibly be very seriously hindered by any action they may take, and if they cannot prevent its adoption the only sensible course would appear to be to cast an anchor to windward and begin to get acquainted with the new comer by devoting spare time and spare room to the care and storage of such vehicles. With the coming rapid increase of motor vehicles in this city the storage problem will grow in importance. The Automobile Club will provide for this need at the outset, of course, but additional space will soon be required, and this enterprising livery stable keepers are in a position to furnish. If their employees are ignorant of the motor carriage let them begin to study it as a means of increasing their wages, just as the proprietors themselves should study it as a means of increasing their profit. There is money to be made in catering to a new and enthusiastic demand.

Want All Motor Vehicles Licensed.

The aldermen of Boston are wrestling with an ordinance to compel the licensing of all motor vehicles. The ordinance introduced reads as follows:

"Nor shall any owner or driver of any vehicle drive it or permit it to be driven on the streets of Boston by power of steam, gas, gasoline, naphtha, compressed air, electricity or combination of any or all without a permit from the Board of Aldermen."

There is no shadow of justification for the licensing of motor vehicles, unless all vehicles are to be licensed. The motor

vehicle is not a road destroyer like the horse, but a road maker; it is safer and more manageable than a horse; it will relieve the congestion of the streets and facilitate travel and traffic in general. How, then, can it rightly be subject to restrictions from which horse vehicles are exempt?

This matter was quite fully discussed in our issue of April 5, and it is safe to say now, as was said then, that any such general ordinance as that cited above would quickly become a dead letter if the lawmakers are foolish enough to pass it.

Excluded From Chicago Parks.

The attitude of the South Park Board of Chicago, Ill., in excluding all motor vehicles from the park driveways and boulevards, on the ground that they are dangerous to horses, has excited the wonder of the conservative East, where, if anywhere, such adverse action might have been expected. That Chicago with its boasted progressiveness should be guilty of such reactionary legislation proves how deep-rooted a prejudice still exists against the new mode of locomotion in great centers of civilization.

The board's action has naturally aroused strong resentment in the western metropolis. Local manufacturers of motor vehicles are offering to users of such vehicles the services of their attorneys, free of charge, in case of arrest for violation of the law, and it is stated that if the board persists in enforcing the obnoxious measure, the very promising motor plants which have been established in the western metropolis will be compelled to remove to less hostile fields. Owners of motor carriages began to openly defy the board by driving their vehicles on the interdicted ground, but no arrests were made, the explanation from the authorities being that action would be deferred until Monday.

The other park boards of Chicago freely criticize the South Park officials, as do the mayor of the city and other prominent citizens. The cause assigned for the prohibition, namely, that motor vehicles frighten horses, is generally ridiculed as flimsy and weak, comparable with the foolish objections offered against the bicycle fifteen or twenty years ago, and having equal force against the locomotive, the trolley car and other necessities of modern civilization.

Of course these modern Dogberrys will soon be forced to reconsider their hasty decision, and will no doubt ere long be riding in the prohibited vehicles themselves on these very same boulevards. In fact we would suggest that the surest way out of the dilemma would be to loan the members of the board motor carriages for their own use. A few days' actual experience with motors will convert the recalcitrant guardians of the parks and lead them to rescind their resolution at once.

The Curved Line of Beauty.

In glancing over the pages of recent issues of *THE HORSELESS AGE* one must be struck with the great improvement in the design and finish of the vehicles shown now as compared with those illustrated a year or two ago. While the mechanical problems are by no means all solved yet, the basic principles of construction are sufficiently established to permit our builders to give more attention to the grace and proportions of their product. A still more liberal use of the curved line of beauty will undoubtedly be found in the pleasure vehicles of the future.

More Road Lessons

Again the editor urges those who are using motor vehicles to contribute their experience to our columns for the benefit of the industry. Many of our readers who contemplate purchasing motor carriages have written to express their appreciation of this department, and we hope the interest in it will not be allowed to flag. Every cross country trip will afford material for a narrative both interesting and instructive.

Width of Tread.

The width of the tread of a motor carriage depends on the roads over which it travels. If it is intended for country roads—American country roads—it should be of standard tread to gauge with the horse vehicles, which now make, and for some time to come will make (or unmake), country roads. Either a wider or a narrower tread will bring the wheels into the roughest parts of the road, and the vibrations and shocks will be unendurable by flesh or steel. These reasons disappear when roads are smooth, like city pavements. Hence it seems probable that light, narrow track carriages will be largely used in cities where storage room is also an important item.

Driver or Motorman?

A reader of *THE HORSELESS AGE*, writing of terminology (on another page), makes a plea for the plain Saxon word driver, instead of motorman, to describe the person who manages a motor vehicle. The good old English term is certainly far preferable to all other terms offered, with the possible exception of motorman, and the only reason why this word might be chosen instead of the earlier and more general term is because it has already obtained currency in the trolley industry. As between the two terms it is hard to say which is likely to win; probably both will be used. At any rate the use of the briefer and more familiar Saxon term should be encouraged.

Winton-Charron.

Little progress seems to have been made in negotiations for the Winton-Charron race since our last issue. Mr. Winton

declines to make a big gamble of the race and M. Charron will consent to nothing else. The New York newspaper which has the American end of the affair in charge announces that if Mr. Winton will not accept Charron's terms some other American manufacturer will. The name of the other American manufacturer is not given.

Short Distance Road Contest.

NEW YORK TO IRVINGTON AND RETURN, JULY 20.

Our readers will recall the *Cosmopolitan* contest of May, 1896, from the City Hall, New York, to Irvington-on-the-Hudson and return, which was won by the Duryea Motor Wagon Co., of Springfield, Mass., several of whose vehicles returned to the City Hall the same night, while of the other two entries one stalled on the outward and the other on the homeward stretch. The prize amounted to \$3,000.

A second contest from New York to Irvington is now announced, to take place on July 20. The promoters of the enterprise are the Automobile Co. of America, manufacturers of the Stanley steam carriages, and the amount of the prize is \$2,000, which, however, may be increased by manufacturers or others interested, to a sweepstake. The competition is open to all comers.

Mr. Barber stated to the editor of *THE HORSELESS AGE* that their object in holding the competition was to stimulate the industry in this country. He believed the practical qualities of the motor vehicle could be much better brought to the public attention by a short distance contest and by manoeuvres for points than by a long distance race, which is a test of the nerve and expertness of the drivers rather than of the relative excellence of the machines.

The number of points on which the decision will be based is 165, divided between speed, safety, hill climbing, cost of operation, price, durability, ease and simplicity of control, ease of obtaining fuel, noise, odor and appearance. Of these, speed, safety, cost of operation and hill climbing are each given 20 points; appearance counts 15, and all the rest 10. This schedule is subject to revision by the judges, who are to number five, General Nelson A. Miles, who was one of the judges of the *Cosmopolitan* contest of 1896, being the chairman, with power to choose his associates.

The route furnishes sufficient variety to give an all round test of the practicability of a motor carriage. The city streets will afford an example of stopping and starting, the road beyond the city will enable the vehicles to show fair speed, the detour through the private park of Henry Willard will prove the hill-climbing capabilities of the contestants, and other tests will be required by the judges at Irvington.

In order to eliminate chance as far as possible each manufacturer will be allowed to enter three vehicles.

Inquiries should be addressed to A. L. Barber, 11 Broadway, New York.

Stable for Gasolene Vehicles.

At 213 West Fifty-eighth street, New York, the American Motor Co. have opened a stable for the care and storage of all kinds of gasolene vehicles. Competent persons are always on hand to make repairs when necessary.

This is the first stable of its kind in New York City.

LONDON NOTES.

LONDON, June 8, 1899.

BUSY SEASON IN THE MOTOR WORLD.

This week the motor world in France and England may be said to have entered on its busy season.

SECOND ANNUAL CAB TRIALS.

The second annual motor cab trials were commenced at Paris on June 1, fourteen vehicles entering the competition, namely; A coupé for two persons, a victoria seating four, a cab for two and a delivery wagon, entered by the Compagnie Internationale de Transports Automobiles, owners of the Jenatzy electric system; a cab, a coupé and a mylord, each for two persons, entered by Ch. Jeantaud; a delivery wagon of Milde & Co., a coupé for four, a coupé for two and a victoria for two, entered by Krieger; a delivery wagon of A. Clement, and two petroleum vehicles, a coupé for two and a delivery wagon, by Panhard & Levassor. It will be seen that with the exception of the last two all the entries are electric.

The three routes or courses over which the vehicles are to run are the same as those selected for last year's trials. The committee of the Automobile Club having the competition in charge is composed of MM. G. Forestier, president; Count Chasseloup-Laubat, secretary; L. Barbet, M. Bixio, G. Broca, G. Collin, P. Eschwege, Pierre Giffard, P. Herard, M. Hospitalier; Ch. Jeantaud, L. Lemoine, A. Michelin, A. Monmerqué, G. Prevost and Baron Thenard. According to reports the vehicles have behaved much more regularly than was the case last year, and much faster time has been made, while troubles due to mechanical derangements have been much less frequent.

The next item on the list of events is the series of motor car trials organized by the Automobile Club of Great Britain. These start to-morrow in the neighborhood of Richmond Surrey and will extend to the 15th inst.

THE PARIS SHOW.

On the 13th inst. the Automobile Show in Paris will open its doors and will continue open until July 3. From all accounts this will be the show of the year, greatly exceeding in extent the exhibition of last year. Four days later, the 17th inst., will see the opening of the English Automobile Club's show at Richmond, near London. This closes on the 24th inst., and less than a fortnight later (the 3d of July) another show—under the auspices of the *Motor-Car Journal*—will be inaugurated at the Agricultural Hall, London, while from July 29 to August 2 a series of heavy motor vehicle trials under the auspices of the Liverpool Self-Propelled Traffic Association is fixed to take place. It will thus be seen that those whose business interests are centered in the horseless vehicle movement on this side of the Atlantic are likely, instead of passing a quiet summer holiday by the sad sea waves, to enjoy a period of rush which has so far not been experienced in the motor world.

THE THREE TON LIMIT.

Some of the difficulties which builders of heavy motor wagons in England have to face were brought to light in the course of the discussion on a paper read at the Institution of Civil Engineers in London yesterday. The present state of the law in England provides that the tare weight of a motor wagon shall not exceed three tons. In the opinion of J. T. Thornycroft, of the Steam Carriage & Wagon Co., of Chiswick, S. W., this legal limit is such as to prevent the building of a motor

wagon capable of transporting a useful load of from four to five tons. Even for a load of three tons, it has only been possible to keep within the requirements of the law as to tare weight by using aluminum, nickel and high grade steels in the various parts of the wagon and its mechanism, thus increasing the cost very greatly. Mr. Thornycroft is anxious to see the present laws amended in so far as to allow of a tare of four and a half tons for a vehicle carrying loads up to five tons, which would permit of heavy motor wagons being produced on a large commercial scale, as while the efficiency would in no way be sacrificed, the first cost of the vehicles would be considerably reduced.

AUTOMOBILE CLUB REOPENED.

It was at one time said that the closing of the Automobile Club by the French Government would interfere with the motor vehicle exhibition at the Tuileries. Later advices, however, show that the exhibition is to be allowed to proceed. The Automobile Club is one of the institutions of the kind in Paris in which politics were severely let alone, and it is much to be regretted that it should have become involved in this way. The club has been reopened, however, and it is evident that the government must have satisfied itself of the legitimacy of the objects of the organization.

NAPIER GASOLINE MOTORS.

I am now able to send you further particulars of the new petroleum vehicle motor which has just been put on the market by D. Napier & Son, of Vine street, Lambeth, London, E. C. The motor is a vertical one, having two cylinders, and at 780 revolutions is stated to give 7 H.P. on the brake, the cylinders being 4 inches diameter, and the stroke 6 inches. The cylinders and valves are provided with a water jacket. The ignition is electric, enabling a wide range of speeds to be obtained by varying the position of the commutator while the motor is running. The valves, which are made on the interchangeable system, are arranged in such a way that they can readily be removed for cleaning, etc., it being necessary only to loosen two screws and remove one nut. A special device is provided for raising the compression valve at starting, a crank handle being provided to set the engine in motion. The governors are of the centrifugal type, controlling a hit and miss device, which cuts out one cylinder at a time. As regards the carburettor, it is that known as the "Longuemare," which is one of the most popular devices of the kind in France. The weight of the motor complete, with carburettor, pump and fly wheel, is stated to be 300 pounds.

MOTORS AT THE SEASIDE.

The way things are going there will soon not be a seaside resort in England which is not provided with a service of motor vehicles competing with the old horse drawn wagonettes and char-a-bancs in conveying visitors to places of interest in the surrounding districts. Blackpool led the way with a service some time ago, followed quickly by a similar service at Llandudno in Wales. Since then motor vehicle services at seaside resorts have sprung quickly into existence. Writing from memory Brighton and Oarton have now each a service, one has just been started at New Brighton, one at Torquay, while similar departures are about to be made at Hastings, Dover, Eastbourne, Southport, Margate and several other places on the English coast. Properly managed a good deal of money can be made in the summer season with services of this kind, and as an indication of their popularity, it may be mentioned that during the week just passed one carriage carried no less than 3,000 passengers.

CAMBIER ELECTRIC AND STEAM VEHICLES.

In addition to petroleum vehicles Cambier & Co., of St. Maurice, Lille, France, are now taking up the manufacture of electric vehicles. They are at present constructing a four-seated electric dog-cart, provided with a Postel. Vinay electric motor while the battery, of a type devised and patented by them, weighs only 660 lbs. and is said to have a capacity sufficient for a run of 70 kilometres (43½ miles) on one charge. It is also stated that Cambier & Co. are constructing a ten-seated steam omnibus for the forthcoming motor vehicle show at Paris.

MORE VEHICLES FOR THE FRENCH SOUDAN.

Towards the end of last year two motor vehicles, a small omnibus and a wagon of the Amedé Bollée type, constructed by de Dietrich & Co., at Luneville, France, were taken out to the French Soudan as an experiment by M. Felix Dubois. The trials proved so successful that this gentleman is reported to have fixed up a contract with the governor of the French Soudan to establish a motor vehicle service between Bamaton and Kages, a distance of about 250 miles, and according to a French contemporary an order has been placed with the Luneville concern for no less than eighty-five vehicles for the service.

The Coventry Machinists Co., Ltd., of Coventry, makers of the Swift cycles, are constructing an experimental motor carriage. It is also said that the Humber Co. have contracted to build a large number of light motor vehicles to the order of Pennington & Baines. Another cycle concern which is preparing to enter the motor industry is the Eadie Manufacturing Co., of Redditch, which is well advanced with its plans for manufacturing motor tricycles.

It is reported from Paris that an electric hose wagon is approaching completion at the works of the Etat Major des Sapeur-Pompiers in that city. In addition to hose, etc., the wagon has accommodation for eleven firemen, and is expected to be able to attain a speed of fifteen miles per hour.

Some excitement has been caused in the Midlands this week by a report that the Columbia Electric Vehicle Co., of Hartford, Conn., had just purchased a couple of acres of land at Coventry, on which to erect a large works for the manufacture of electric vehicles for the English market.

COMMUNICATIONS.

"The Students' Plunge Battery."

NEW YORK, June 17, 1899.

Editor HORSELESS AGE:

In answer to the many inquiries I have received from your recent mention of my plunge sparking device, permit me to spare myself the labor of further correspondence with your readers by stating that the battery I employ is known as the "Students' Plunge Battery." The Fuller battery, which was mentioned by another correspondent in your journal, has too high internal resistance for this work. Yours truly,

E. H. LYON.

To Transport Two or Three Tons.

DAYTON, O., June 16, 1899.

Editor HORSELESS AGE:

Please advise if there can be had, at the present time, a horseless vehicle that can transport loads of two to three tons at a speed of six to eight miles an hour. If you know of any manufacturer who would figure on such a vehicle please advise us. We are not particular as to the motive power, whether electricity, steam or explosive engine.

Yours very truly, NATIONAL CASH REGISTER CO.,
O. P. Gothlin, Traffic Manager.

How to Build a Front Axle.

PENDLETON, Ore., June 8, 1899.

Editor HORSELESS AGE:

Please give a simple sketch showing how I could build my front axle and wheels on the oscillating principle.

Yours truly, JOHN D. PEUCK.

[We refer the inquirer to the article on "Front Axles" by Robert I. Clegg, in this issue—ED.]

A Plea for Plain English.

3 HEAD PLACE, BOSTON, June 16, 1899.

Editor HORSELESS AGE:

With the advent of the electric motor as a propeller of street cars, and with the appearance of that and other motors as successors to the horse in moving various vehicles, there naturally arises a call for some new words, but the eagerness to show originality in this direction has been carried to a preposterous extreme.

One word has had a particularly hard time among the philosophical inventors: the word applied to the man who manages and controls the motor.

We call the man who controls a horse a driver. Why not apply the same word to the man who controls the motor?

Our English cousins show much better taste than we in this matter.

When the locomotive replaced the horse in hauling cars, the English called the man who operated the engine "driver," but we must have the ponderous and entirely unnecessary term "locomotive engineer." Both words are necessary, for the engineer is also the man who lays out and builds the railroad.

So on the electric cars we use the clumsy "motorman" instead of driver, which would express the idea equally clearly and much more euphoniously. I never have heard any argument which seemed to me to offer any excuse whatever for discarding the word driver when changing the thing driven.

I hope this seeking after novelty will not be continued in the case of other vehicles. Let us not coin words when unnecessary.

Pray use the influence of your journal in favor of good English rather than for absurd Græco-Latin abominations.

Yours very truly, ELIOT L. CALDWELL.

Another Automobile Co. of America.

A new and important incorporation is that of the Automobile Co. of America, capital \$2,500,000, principal incorporators, A. L. Barber, of the Barber Asphalt Paving Co., president; John Brisben Walker, proprietor of the *Cosmopolitan Magazine*, vice president; and Samuel T. Davis, Jr., treasurer.

The company has purchased outright the motor carriage business of the Stanley Bros., Newton Mass., and will immediately enlarge the plant at Newton or remove it to Irvington-on-the-Hudson, the Stanley brothers continuing as general managers.

Branch factories will be established in England, Germany and France, it is said, Mr. Barber leaving for Europe to superintend their erection on the 28th inst.

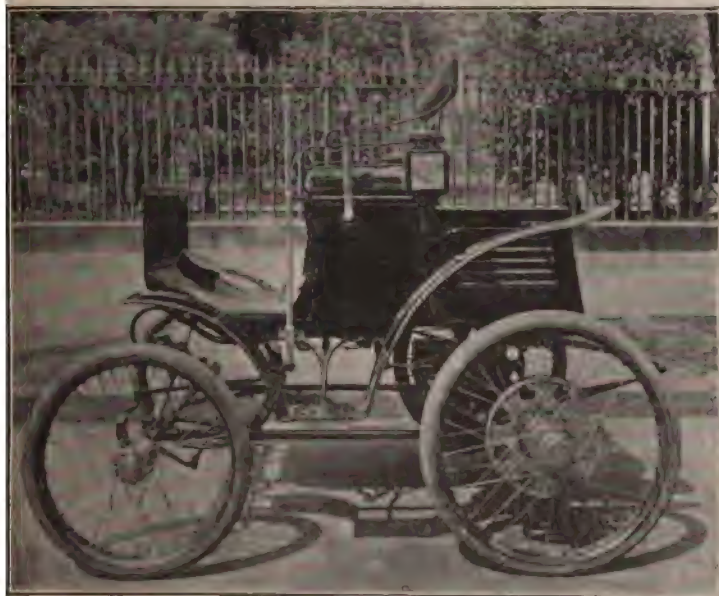
This corporation is organized under the laws of West Virginia, and must not be confounded with the Automobile Co. of America, with offices at 32 Broadway, whose birthplace was New Jersey. The New Jersey corporation antedates the West Virginia corporation by several months, a fact which was overlooked by the newer organization. The name will probably be changed to avoid confusion.

Anthracite Coal—Not Kerosene or Gasolene—for Fuel.

The Graham Equipment Co., 170 Summer street, Boston, Mass., are making three standard trucks, designated A, B and C. A is intended to carry from 1,000 to 2,000 lbs.; B, from 4,000 to 10,000 lbs., and C from 6,000 to 14,000 lbs. All parts are interchangeable. They are also prepared to roll rims of any size and shape.

As a source of power they have decided to use a small five-cylinder compound engine, employing the five-cylinders simple for starting and climbing steep grades and compound for ordinary service.

The fuel will be anthracite coal, and not kerosene or gasolene.



RIKER ELECTRIC RUNABOUT.



RIKER ELECTRIC DEMI-COACH.

Two New Riker Vehicles.

DEMI-COACH.

Two of the most attractive vehicles in the recent Riker exhibit at the New York Electrical Exhibition were the demi-coach and the runabout, which were not finished until near the end of the show.

The demi-coach, weighing 4,200 lbs., has a wheel base of 80 inches, and a tread of 54 inches front, 61 inches rear. The rear wheels are 42 inches and are shod with $2\frac{1}{2}$ inch solid tires.

It has a carrying capacity of four in addition to the operator and attendant.

Two motors of two K. W. each are used. The controller gives three speeds ahead and two to the rear. The maximum speed is ten miles an hour, and the total mileage on each charge of battery is twenty-five on level macadam road.

The usual combination voltmeter and ammeter, electric side lights and front steering are employed.

RUNABOUT.

The runabout which was awarded by the management of the Electrical Exhibition to the actress who obtained the greatest number of votes by popular ballot during the show, weighs about 1,300 pounds and carries one passenger in addition to the operator. The wheels are: Front, 28 inches; rear, 32 inches. The wheel base is 50 inches and the tread 48 inches. Pneumatic tires of $2\frac{1}{4}$ inches diameter are employed.

Two motors of $\frac{1}{2}$ K. W. each are used. The controller gives three speeds ahead and two to the rear the maximum being ten miles an hour. The total mileage of this vehicle is likewise twenty-five on level macadam, and it has the electric lights and voltmeter and ammeter like all other Riker vehicles.

New Compressed Air Company.

On June 12 the Automatic Air Carriage Co. was incorporated at Albany, N. Y., with a capital of \$6,000,000, to manufacture and sell carriages propelled by compressed air or gas, or by a combination of the two. The directors are Edward A. Willard, also a director of the American Air Power Co., Edward A. Willard, Jr., Robert R. Blood, Charles J. Hensley, and Seymour L. Husted, Jr., all of New York City. The system of the company is different from any yet proposed by compressed air experts, and is claimed to be a decided improvement over all preceding compressed air locomotion.

Front Axles.

BY ROBERT I. CLEGG.

A simple means of hanging the leading axle so as to give full liberty for each wheel to rest upon the ground without bringing undue strains upon the frame is not nearly so easy to find as it sounds.

Assuming that the frame is designed to cross immediately in the rear of the plane of oscillation; then the supporting brackets can be very short and correspondingly stiffer. The sketches, Figs. 1, 2 and 3, are intended to illustrate an arrangement to fit such conditions. The same letters are employed to indicate identical parts in each figure.

E is the axle, enlarged at the center to allow boring to size of stud body, which hangs the axle to the supporting bracket K. H is the angle steel frame, to which are bolted or riveted K, as well as the slides L. F is the bearing for the L-shaped wheel spindle G.

If the body of the vehicle is mounted on springs, supported by the frame H, of adequate resiliency, the above may serve the purpose desired; should, however, the builder desire to get in additional springs, not only for his own comfort but to ease the strain and shock that may be brought to bear upon the machinery—and this is an important feature in the design of motor vehicles—then I would advise the substitution of the device in Fig. 4 for the arrangement shown in Fig. 3. Here J takes the place of K, and the axle E is bearing the burden of H through the instrumentality of the spring and spindle passing through J.

Should the builder undertake to make the spring it would be easy to direct him to data for that purpose. It is decidedly easier for him to apply to one of the several engineering firms who make a specialty of springs, state the diameter of rod, or tube on, or in, which the spring is to be placed, maximum load and distance spring should compress for given increment of load up to the limit required.

It has been assumed that the frame and axle are close together, as they should be. I have had an experience where the two were about a foot apart and this called for entirely different treatment, and I will sketch this plan with pleasure if it is desired.

The three-point suspension is undoubtedly the correct principle whether we are designing engines, lathes or motor vehicles, and few mechanical engineers have disputed the conclusions that Professor Sweet enunciated many years ago;

nevertheless the writer has met one manufacturer who declared that he would have no provision for an oscillation of the front axle other than that given by straining the several joints and members of the frame. When the frame has little load to carry and is furthermore made of high carbon steel, there can be no doubt that it will stand a long continued service; but it would be wrong to take one's data from such favorable conditions to the shortcomings of the design, and thereby perpetuate a mistake.

Far too little stress is laid, too, upon the rigor of the service to which the front axle is subjected in every-day use. We are prone to estimate the front axle as simply sustaining a certain percentage of the total load, though this comes far short of the true state of affairs. Some allowance should be made for the strains when turning corners, etc., as well as for the abuse when the wheel is run against the curbing by misadventure; such a glancing blow brings one nigh to disaster; in fact, the three most important breakdowns I can just now recall have been failures of the front axle.

To Test the Law.

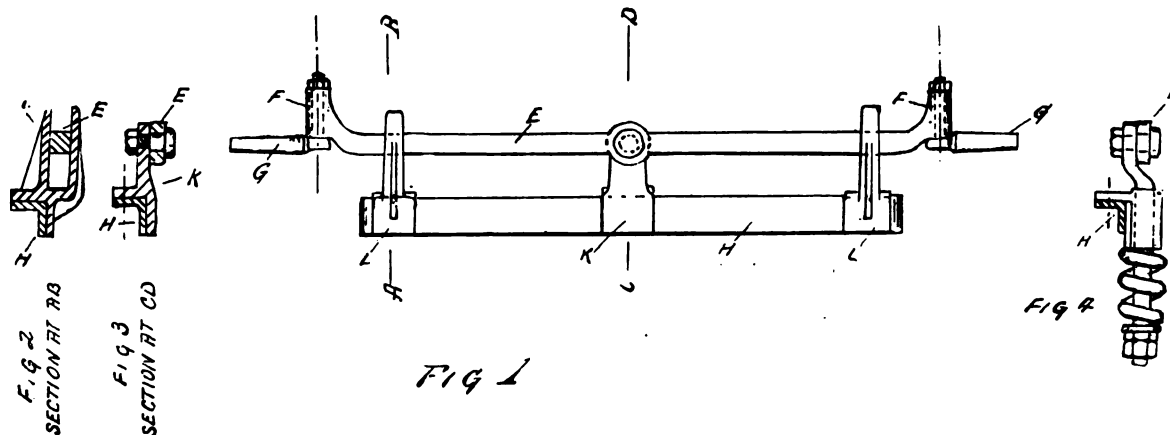
The expected clash between the motor vehicle promoters and the Park Board of Chicago has taken place.

True to their word the commissioners enforced the law on Monday. C. E. Woods, general manager of the Fischer Equipment Co., and George T. Marchant and A. H. Smith, superintendent and treasurer of the same company, appeared on the Boulevard, and Mr. Marchant, the driver of the vehicle, was placed under arrest, but was speedily released on bail. The matter will be immediately brought into court by the manufacturers and owners of motor vehicles in Chicago.

As a direct result of the unfriendly attitude of the South Park Board it has been decided to organize an automobile club at once, for both pleasure and defense. A meeting is to be held on Wednesday, June 21, to take the necessary steps for organization, and the first work undertaken will be to endeavor to have the obnoxious measure rescinded, or to test its constitutionality before the courts.

NEW YORK TOO.

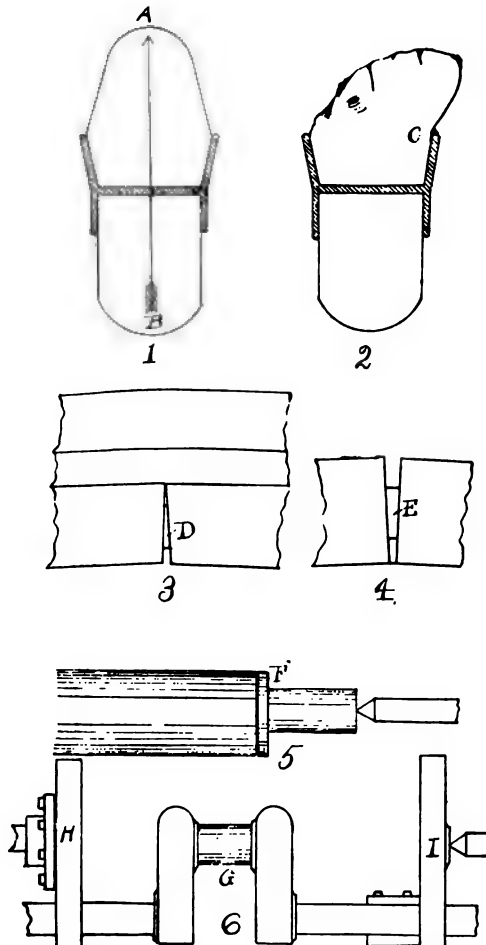
The action of the Chicago authorities has roused the owners of motor carriages in New York City, and concerted action will also be taken here to open the drives of Central Park to private carriages at least. Prospect Park in Brooklyn, Riverside Drive, New York and other New York parks are open to motor vehicles, but the Central Park authorities have so far withheld the right of their domains.



Motor Vehicle Engineering.

CARE AND REPAIR OF MOTOR TIRES.

The increasing use of motor carriages and wagons calls for facilities for keeping the tires of the wheels in serviceable condition, inasmuch as the constant wear and tear to which they are subjected necessarily calls for certain repair work. In addition to the ordinary wear of the tire, manufacturers have to provide for ill-usage on the part of the owners of the vehicle and defective workmanship of the repairmen. A solid tire, for example, when sent out from the shop is in perfect alignment, sets squarely and firmly in its channel, and the latter is securely fixed to the felloe of the wheel. A line drawn through the felloe from the center *b*, Fig. 1, to the center of the tip of the tire at *a*, will prove that the adjustment is true. If the wheel and tire are properly cared for the rubber will hold its form and there will be no deflection from the alignment, or breaking and chipping of the tire, except that which accompanies the usual wear of rubber tires on pavements and rough roads.



But sometimes a defective spoke in the wheel allows the felloe to spring out of line and unsettle the adjustment of the channel. The writer has had wheels brought into the shop with the channels so badly warped out of line through springing of the felloes that the weight of the vehicle would cause the tire to be pressed over to one side, as in Fig. 2. The edge *c* would of course be badly cut, while the other portions of the

tire would be cracked and broken, due to unequal pressure and the mechanical strains of uneven bending. As soon as a tire loses its alignment from loose channels, felloes deflected out of line, open joints in the felloes, ends knocked down, hubs with battered mortises, shoulders of spokes worn, high or low places in the rim, loose tenons to spokes, tire loose in the channel, lap of tire open, or other defect in either the tire or wheel, the vehicle should be run into the repair shop and not taken out until the trouble is rectified or until a new wheel and tire are substituted for the imperfect ones. The mere loosening of the tire from its seat in the channel may be easily repaired by first clearing out all foreign matter, such as dust, pieces of gravel, etc., and then applying cement, according to directions which go with the bottle. But when a tire is out of order owing to defects in the wheel, the repair man or the wheelwright should be called upon.

Many of the motor carriages for light service are supplied with bent rim wheels, in which case the liability of the adjustment of the tires being distributed through buckling and knocking down at connections is comparatively slight as compared with the heavy service wagons, in which the short sawed felloes of the wheel may become checked as at *d*, Fig. 3, or open as at *e*, Fig. 4.

TREATMENT OF DEFECTIVE FELLOES.

Just as soon as the joints open or buckle the channel is sprung out of position and the tire cannot possibly run to advantage. The only practical remedy is to replace the imperfect felloes with new ones. It is almost a waste of time to treat the old ones. The open joints may be closed and considerable time used in making the connections tight. But as soon as the wagon is in service again the chances are that the imperfect felloes will loosen and get out of line again. If new felloes are put in examine the shoulders of the spokes and make sure that the edges are not battered. If they are, and the hub ends of the spokes are perfect, the battered shoulder can be turned off and a hard rubber washer put on, as at *f*, Fig. 5. This washer will make up for the portion turned off.

Do not use any glue in the rim portion of the wheel, as the glued parts will only be loosened by contact with wet from the street. Glue may be used on the tenons of the spokes in the hub, however, as this part of the wheel keeps dry most of the time.

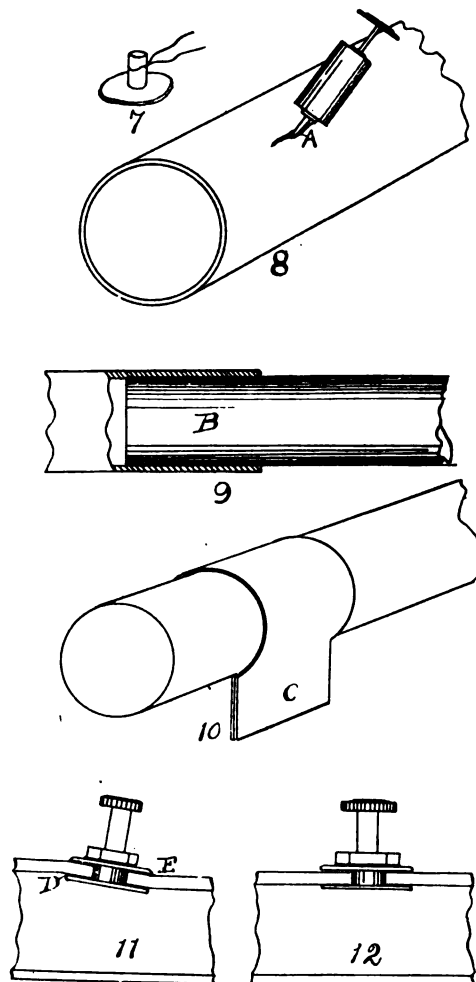
AXLES SHOULD BE TRUE.

It is hardly necessary to inform motor vehicle engineers or repairmen that as soon as a wheel wobbles as a result of a sprung axle the tire is subjected to increased wear. If the axle carries the crank, as in some patterns of oil and steam motors, the effect of the irregular motion on the tire is greater. Recently the crank shaft of a motor was sprung, and after truing it the wrist pin had to be turned down a fraction. This was done with the rig shown in Fig. 6. Two cast iron disks, *i* and *h*, were procured, each 1 inch thick and 12 inches in diameter. A hole was bored in each disk near the edge, so as to receive the ends of the shaft and bring the center of the pin opposite the turning center of the disks as shown in *M*. One disk was fitted with means for securing the shaft and the other was screwed to the face plate of the lathe. This arrangement brought the pin *g* on the turning center of the lathe, and the pin was easily trued by cutting off a few turns with the cutting tool.

REPAIRING TUBE TIRES.

As motor vehicles are furnished with all kinds of tires it will be necessary to observe the method of repairing leaks and fractures in single tube tires. The process is shown in Figs. 7

and 8. In Fig. 7 is the style of patch carried by all repairers of tires. The leak in the tire is located by blowing up the tire in water, and when found the patch is forced into the hole by means of a pair of long, thin-pointed pliers. It is a good plan to tie a piece of string about the stem of the patch



so as to hold the patch up and in place against the inner side of the tire while the cementing substance is being injected with a common syringe, as at a, Fig. 8. Before applying the cementing material clear the parts from foreign matter by using a little benzine. After the cement is applied draw up on the string so as to adjust the patch firmly and then cut off the string at the edge of the tire. Then shave off the stem and the job is done. Some apply rubber cement or soft rubber over the patched place to give the part a smoother appearance.

REPAIRING A LEAK IN AN INNER TUBE.

If the tire is of the double tube pattern, and there is a leak in the inner tube, the process of repairing may be effected as with the single tube, provided the inner tube is removed so that it can be gotten at, or the method shown in Fig. 9 may be adopted.

It consists in entirely cutting out the broken or split portion and putting a section of a smaller tube inside, drawing the ends of the tube over and cementing them as represented in the cut, in which the inserted joint is marked b. Some of these inner tubes are very elastic, and can be extended enough

to permit one end being set into the other for the same purpose as above.

CEMENT MAKES RUBBER SHEET CURL.

The curling of rubber sheet patches as soon as cement is applied is very troublesome. It can be prevented by putting the sheet rubber patch over a round surface, as in Fig. 10, and holding it tight at c, applying the cement evenly with a brush. After the cement sets with the rubber stretched smooth the curling will not occur.

SHOULD EXAMINE THE VALVES.

Motor vehicle machinists often make the mistake of overhauling tires, wheels and other parts of the rolling portion of the carriage or wagon to locate a trouble that exists entirely in the valves of the tires. In a recent case a party did everything he knew to stop the leaking of a tire without effecting a remedy. It was finally discovered that the valve was forced out of its correct position by the wheel rim. The tire had loosened and slipped previously, and in cementing the tire back care had not been taken to get it in the same place. It was shifted forward a fraction of an inch and tipped the valve stem accordingly. The conditions are shown in Fig. 11, in which the edges of the washers are shown forced upward at d and downward at e. The continual abrasion of the edges of the metal washers on the rubber was a mechanical action which weakened the tire material at that point, finally starting a slight air hole and leakage. The trouble was remedied by removing the tire from the rim, straightening the valve stem and putting on new and larger washers, as in Fig. 12. The larger washers covered the defective place in the rubber and stopped the leak. The tire was then re-cemented to the rim and care taken to have the valve stem perfectly perpendicular, after which leakage ceased.

THE INSPECTION OF GAS AND OIL ENGINES.

The success of gas, oil, steam, air and other forms of engines used for power purposes on vehicles depends to a considerable degree upon the methods of adjustments and care of the mechanism. Motors are different from ordinary engines in that the motor is often invisible and does not receive the attention that is given to engines that are exposed to view. In many instances neglect of the motors has been a prolific source of trouble. Manufacturers of motor vehicles carefully test and adjust the motors before delivering the carriage or wagon, but the ordinary wear and tear which accompanies the mechanical motions of a vehicle necessarily affects the running gear more or less.

No part of a motor requires more intelligent care in the interests of safety and economy than the cylinder and piston, mechanically considered. The builders are well aware of this and take special precautions to deliver the machine perfect in this respect. But there should be regular inspections of the cylinder, in order to detect and rectify any existing imperfection due to wear, dust or loosening of some mechanical part. One of the most common causes of loss in the cylinder is leaking packing rings in the piston. When these rings do not properly fit the cylinder bore, or are faulty in the joints, loss in power results. Sometimes in resetting leaky packing the mistake is made of having the fit too close, with the result that the mechanism is brought to a stop when the carriage is several miles out on the road. The packing in a flange joint may be comparatively loose when cold, but when frictional heat warms up the packing, the flanges and the bolts which hold them together, the expansion causes the packing to be very tight and binds the piston. The remedy is to reset the packing and allow space for expansion.

THE VALVES.

In overhauling the cylinder valves, when replacing them, see that they fit perfectly against the seat, and that the bottom bearings on which the valves ride are at right angles to the valve seat, and in such a condition that the valve will not be tipped away from its seat, but rather against it. This latter condition will be insured by easing off the bottom strip at the inner corner, so that the valve bears hardest at the outer edge. The hinge nut, into which the valve stem is screwed, as well as its trunnion bearings, should fit so that the valve lies closely to its seat, rather than away from it. In adjusting the valves, the marks will be found on the stirrup block that passes through the guide. There are two scratch marks, and the distance between them shows how much the valves should lap over the ports on the bottom side when the port is closed. When the valve is closed, the upper mark should be seen at the top edge of the guide block. By removing the nut and washer from the exhaust cam lever, two scratch marks will be found; these show the lap of the exhaust valve.

CARE.

Owners of motor vehicles should not neglect their machines. The cup bar nibs in the later motors are milled perfectly true, thus insuring the top shafts being perfectly parallel with the bottom ones. In designing this new cup bar particular attention has been paid to the lubrication and cleaning of the necks of steel rolls and roller stands, and the cap bars are so arranged as to leave the roller necks entirely free, so that they can be kept perfectly clean and lubricated without interfering with the top rolls or cap bars.

BORING A VALVE CHAMBER.

In one motor which gave irregular service an investigation showed a badly leaking valve. The valve was of the piston type, and had worn the chamber nearly 1-16 of an inch large, so that the rings, which were of the "split" kind, had lost their elasticity, or rather, had become so worn at the ends that the elasticity no longer served to keep them right. The measurement of the rings required was sent to the machine shop, with orders to have them gotten out as soon as possible, and a little device was constructed for making a short job of the boring process. It consisted in bolting the cylinder to position in a lathe where it was an easy matter to rig up the boring tools for boring out the valve chamber. Considerable damage would have resulted if this work had been delayed. At all events the cylinder would have been ruined. I speak of this incident because it is a particularly good illustration of the value of inspection. Most of the defects that inspectors discover are of such a character that it is not certain that accidents would result from them, and we have to be content with saying that accidents would be very likely to result.

TANKS.

An inspection of gasoline tanks is important, after the vehicle has been in service for a time. In one case the front head was found to be deflected inward about $\frac{3}{8}$ of an inch, though it is impossible to say that this deflection was due entirely to the stress set up in drawing the heads together by the bolts, since it is not certainly known that the heads were originally flat. The back head was also deflected inward, so that after the removal of all strain it had a permanent set of about $\frac{3}{8}$ of an inch. Upon examining the tank internally the inspector found that the pins securing the braces to the heads did not come against the ends of the braces by an eighth of an inch, in some places. The braces would therefore be of no

use whatever until the heads had bulged out enough to take up the slack in the fastenings. The pipe connections should also receive inspection, as they may get clogged with foreign stuff or be bent.

PIPES.

A prolific cause of accidents with motor carriages is due to loosened laps of heaters, etc. A lap which is simply loose may be closed by clinching the rivet heads. But it is frequently found that the joints are affected, in which case the best remedy consists in calking. This may be done with oakum, but lead is the most lasting, if tools are at hand with which to drive the lead home firmly. The custom of stopping up these places with ordinary pipe packing, rosin, putty, china clay, wax, etc., is not practicable, as the stuff is loosened or eaten out in a few weeks again. The machinery should be examined, also pipe connections, for bolts in bad shape. The only remedy is to drive out the defective bolt and replace it with a new one. Grooved places may be due to a flaw in the pipe, or to the action of certain acids which may have come in contact with the joint. Pipes which are discovered in a leaky condition at the joints, may be readily repaired by recutting the thread a little deeper, using a connection of slightly smaller diameter, or by cutting the thread farther along the pipe, on the untouched portion, and screwing the connection over the defective place.

GEARS.

Where it is convenient to do so, the blocks in which run the shafts carrying any pair of wheels on a vehicle motor, whether spur or bevel, should be bolted to one casting, or if on separate castings these should themselves be bolted together so as to insure that the strains given forth by the gears may be properly taken up and not transmitted through any intervening foundations or supports to the shaft, which may not have been intended to sustain such strains and therefore are not likely to be able to resist them, thus giving the gears every opportunity to get either out of or too deeply in gear. In the helical form of gear tooth more difficulties have to be contended with than in the straight form. In the case of bevel wheels the helical form are extremely difficult to put into gear, as they cannot key one wheel on the shaft and push the other one into gear with it; but, instead, the wheels must both be slipped into gear at the same time—the amount of advance of either being regulated by the clearance between the teeth and no more, although sometimes one of the shafts can be lifted with its wheel and put into gear.

The clutch pattern of gear is used on some motor shafts, while other makers have adopted the frictional wheel. The usual troubles are loose keys or set screws, worn or broken cogs, gears too deep in mesh or too far out of mesh, all of which may be set right with the monkey wrench.

MOTOR ENGINEER.

No Franchise Needed in Syracuse.

It will not be necessary for the Common Council to grant a franchise to the Syracusans who want to run automobiles here. It was stated in one of the Sunday newspapers that the council would be asked to grant such a privilege. Such is not the case. Those who introduce automobiles in Syracuse for the use of the general public will do so as a matter of private business. It will not be necessary for the council to grant them a franchise, as no franchise will be necessary. So that all talk of another franchise being put through the council is idle speculation.—*Syracuse Telegram*.

OUR FOREIGN EXCHANGES.

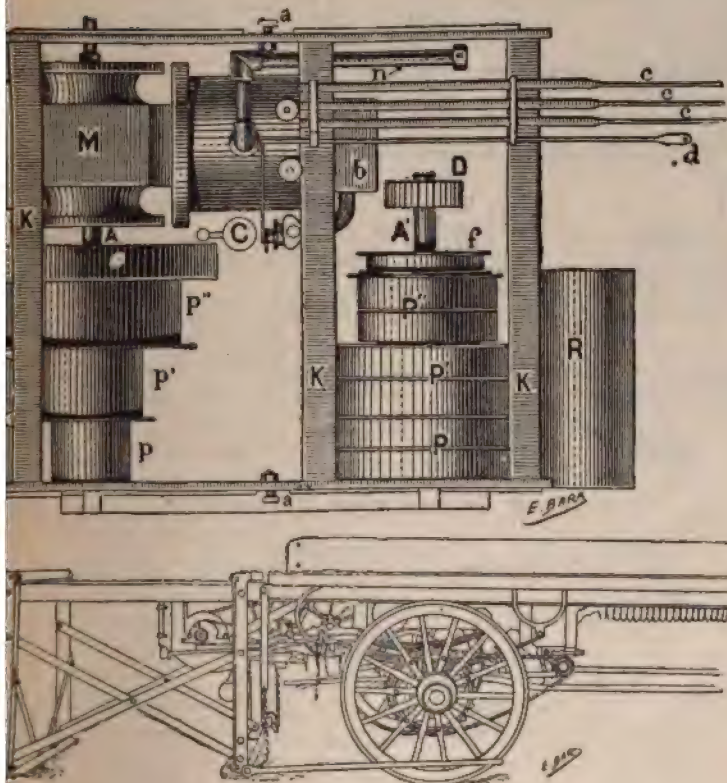
The Pantz "Portable" Motor.

La Locomotion Automobile publishes a description of a motor which can be fitted to a number of different types of vehicle. The attaching and detaching of the motor requires no special skill and can be quickly done. All the machinery is grouped upon a separate frame represented in Fig. 1. The rigid frame K carries the motor M, 6 or 8 H. P., and provided with electric or hot tube ignition, or both. Upon the motor shaft A are mounted pulleys p' p' p', of different diameters, transmitting by means of belts to the pulleys P' P' P' on the shaft A'. Each of the pulleys P' P' P' carries a fast pulley and an idle one, on which the belts are shifted by means of forks controlled by c c c, connected with the levers regulating the vehicle. The pulleys F' P' give the fast speed; P' P' the mean speed and P P the slow speed.

At the end of the shaft A' is a pinion operated directly by the shaft A for forward motion, and by a system of internal gears for the reverse.

When the frame is placed in a vehicle this pinion D engages with a gear which transmits its motion to the drive wheels. Each vehicle has a wheel of variable diameter, according to the nature of the vehicle, and the speed it is to take. The intermediate shaft A' carries a drum f, upon which operates a band brake. The gasoline tank r supplies the burners, b, the carbureter C, and the reservoirs R r communicating with each other.

Each side of the frame has two bolts a, a, the heads of which fit in grooves in the framework of each vehicle in such a manner



PANTZ CHANGEABLE MOTOR AND STANDARD.

that the pinion D engages with the gear of the vehicle, which transmits the power to the drive wheels. The motor and machinery being in the proper position it is merely necessary to fasten the four bolts a a a a to render the whole vehicle firm and safe.

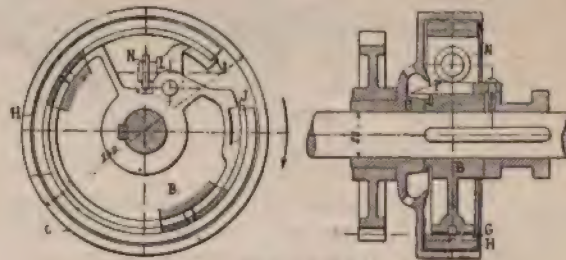
The speed mechanism is then connected to the rods c c, which are attached to the controlling levers. It is claimed that when these bolts are all securely set the vehicle is almost as firm and solid as though the motor had been an integral part of the vehicle. Each vehicle has its own special transmission, carrying the differential and the pinions operating the transmission chains. On the out side of the differential is a gear, which engages with the pinion D, of the motor system and thus transmits power.

To facilitate the change of the motor from one vehicle to another, a stand is provided, having grooves similar to those in the vehicles, so that when the motor apparatus is drawn out of the vehicle it rests upon the stand and can easily be inspected and repaired. The stand has an arrangement whereby its grooves may be adjusted to the same height as those of the vehicle. The entire operation of changing from one vehicle to another requires a few minutes only.

An advantage of this construction is the ease of care and repair, as the body may be washed or attended to and the motive part repaired at the same time.

The Julien Friction Clutch.

The accompanying illustrations show sectional views of a new friction clutch devised by M. Julien and lately put on the market by M. G. Benoit, of 119 Rue St. Mauar, Paris. Figs. 1 and 2 represent a clutch of this type adapted for use on motor-voitures. On the motor shaft is keyed the piece B, round which is fixed a hardened spring-steel band G, to which in turn is riveted a band of leather H. Surrounding these, and running loosely on the shaft, is the pulley, or what may be termed the female portion of the clutch, the boss of which is fastened the power transmitting gear wheel. The spring G, when the clutch is thrown out, is under tension, and so has a tendency, by reason of its elasticity, to open out and make contact with the outer pulley C. To one of its ends is fixed a piece J, which engages in a corresponding recess in B, while at the other end is fixed a piece I, which continually bears against the special-shaped lever L pivoted on B. Perpendicular to its axis this lever carries a roller N. Keyed on the shaft in such a way as to rotate with it, but still free to be slid along



FIGS. 1 AND 2.

it under the action of a lever, is a sleeve to which is attached a wedge P. In the illustrations Figs. 1 and 2 the clutch is shown out of gear, the wedge P being forced in as far as possible. To put the clutch in gear the sleeve and wedge P are made to slowly move to the left; this allows the roller N and the lever L to slowly fall and the spring G to expand until,

when the wedge has been entirely withdrawn from beneath the roller N, the maximum contact between the two parts of the clutch is obtained. It will thus be seen that the contact is the result of withdrawing the tension on the spring band and allowing it to expand, the system, it is claimed, resulting in a very quiet working clutch. The elasticity given to the

reaching the leather band and so affecting its proper working, it will be noticed that the boss of the pulley C is provided with a special cavity, into which any free oil is caught and allowed to pass away by holes in the bottom of the cavity.

Fig. 3 shows a Julien friction clutch combined with a driving pulley for motor carriages, in which a special lubricating ar-

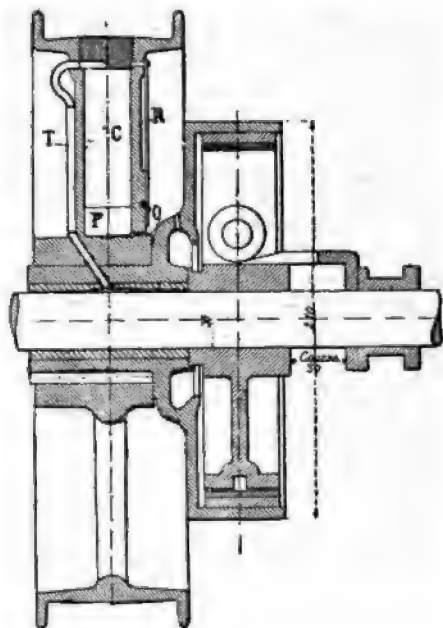


FIG. 3.

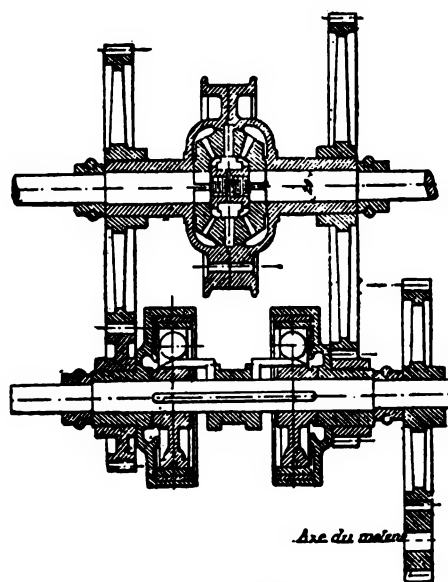


FIG. 4.

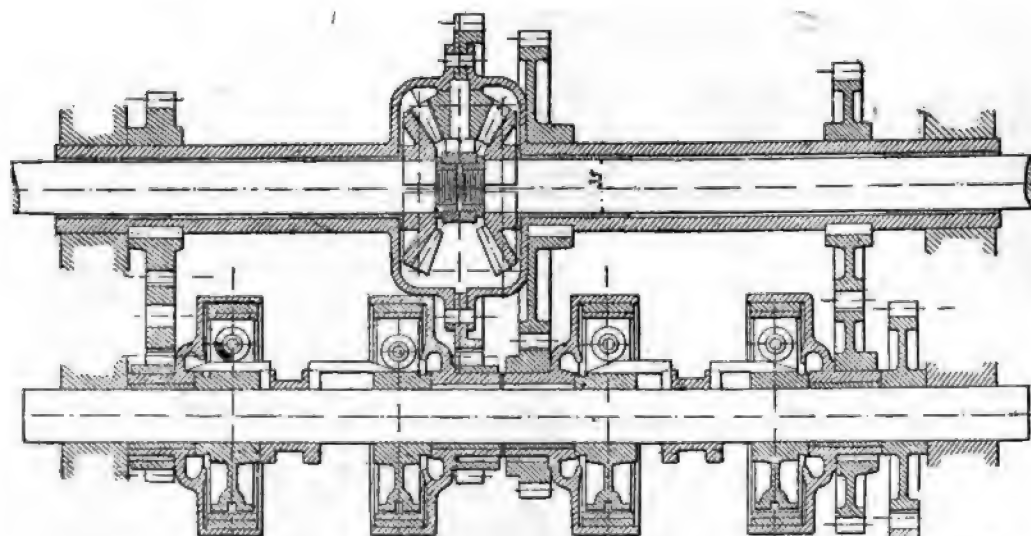
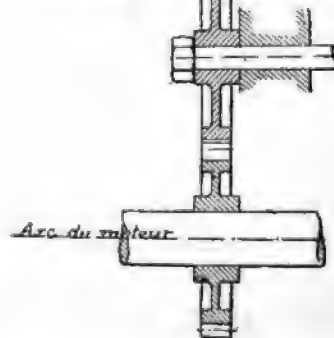


FIG. 5.

spring and the degree of oscillation permitted to the lever L are such that the whole surface of the leather band H is brought into contact with the internal surface of C, this taking place until the leather band is worn down to the level of the heads of the rivets by means of which the band is attached to the spring G, provision being made for the quick renewal of the leather band when worn. To prevent the spring band from getting out of its correct position several small projections are attached to its inner face, these sliding freely in a small groove formed in the piece B. To prevent any oil



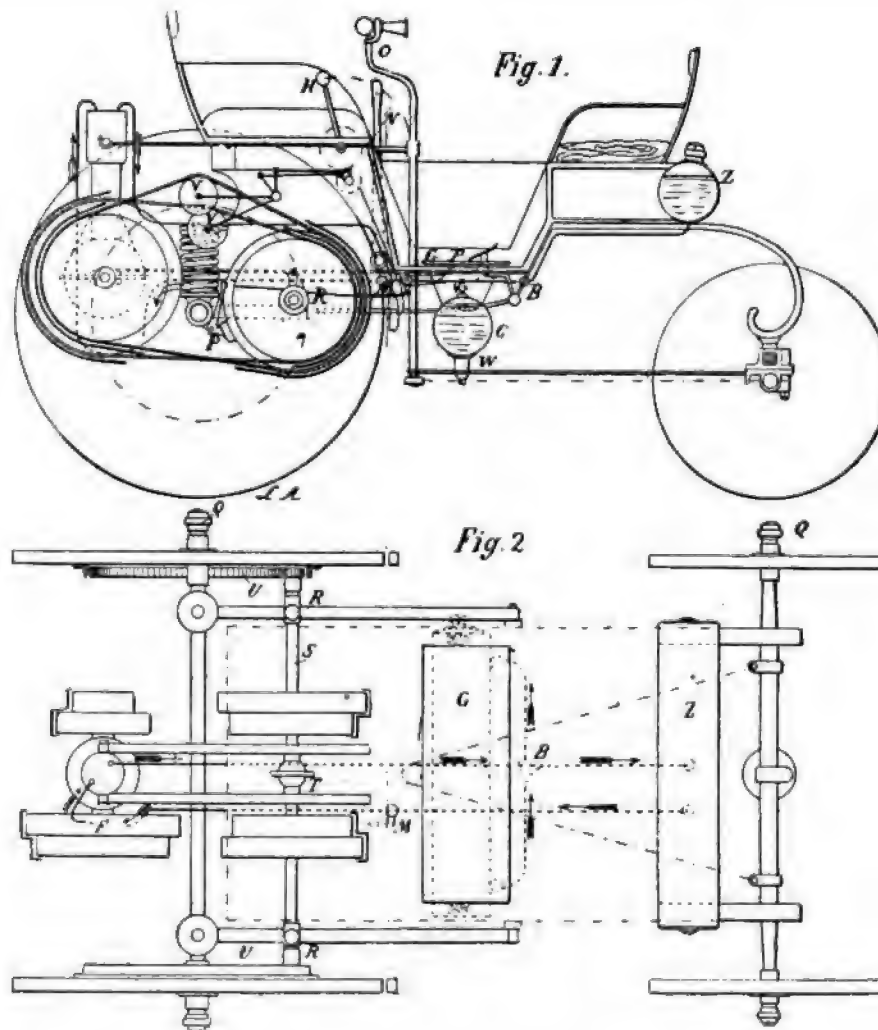
arrangement is provided. One of the arms C of the pulley is made hollow, and is provided with a piston P. This piston works under the action of centrifugal force, and in order to prevent the formation of a vacuum the under face of the piston is placed in communication with the atmosphere by means of a very small hole O, formed in the lower end of the cylinder C. A screw plug is provided at the upper end of the cylinder to allow the latter to be filled with oil; the plug is prevented from becoming unscrewed during the rotation of the pulley by means of a projection held rigidly in place by a spring R. The connection between the cylinder and the shaft is made by means of the pipe T, a constant supply of lubricant being thus delivered to the pulley bearing, owing to the centrifugal action on the piston P. The clutch is made in quite a number of sizes, ranging from a capacity of 1.5 H.P. upwards, at a speed of 100 revolutions per minute. Fig. 4 shows the arrangement utilizing Julien friction clutches, adapted for a two-speed gear for motor cycles or voiturettes weighing under five cwt. The motor shaft is geared by spur wheels to an intermediate shaft on which two clutches of the type shown in Fig. 3 are mounted. Only one sleeve is provided, however, to two wedges, so that moving over the lever to one side gives the high speed, and to the other the low speed. Fig. 5 gives an illustration of a transmission gear for motor vehicles, provision being made for three forward speeds and one reverse motion. It will be noticed that four clutches are used, controlled by two levers, the reverse motion being obtained by interpolating a small pinion between the pinion on the intermediary shaft and the one on the differential shaft.—*Motor Car Journal*.

The Daimler Transmission.

Emil Levassor and Gottlieb Daimler were pioneers in the development of the motor vehicle, M. Levassor using the Daimler motor as the model for his well-known "Phoenix" motor, but while they were thus pretty much in harmony on the motor question, says *La Locomotion Automobile*, they were at variance in their views of transmission, Mr. Daimler preferring belts for the change of speed, while M. Levassor adopted gears and chains. The system at present in use by Mr. Daimler is thus described:

The Phoenix motor is placed in the rear and has two pulleys, one on each side, forming a fly wheel. Four other pulleys are keyed upon the differential S, which controls the rear wheels by means of the two pinions R and the gear V. The proper suspension of the vehicle and frame is secured by large spiral springs, so that the small pinion R oscillates about the axle without interfering with the gear.

The transmission and the four speeds are controlled by four loose belts running over the four pulleys of the motor and the differential. The lever H controls these belts, producing a smooth start and a silent transmission of power. The whole front axle turns about a pivot bolt, and is manipulated by a chain and pinion through the lever O. The lever N operates the shoe brake and the pedal P the differential brake.



DAIMLER TRANSMISSION.

The Dupressoir Motor-Tricycle Speed Reducing Gear.

In our issue of March 24 last we published descriptions, with illustrations, of several devices which have recently been introduced with the view of providing motor-tricycles with a second slow speed, for hill-climbing purposes. Since then still another device of the kind—the “Dupressoir,” introduced by M. P. Dupressoir, of Paris—has come under our notice, and of it we are now able to give illustrations, together with a few brief particulars. Referring to Figs. 1 and 2, it will be noticed that the motor shaft is extended, and carries two pinions—one, M, continually in mesh with the spur wheel I on the axle of the tricycle, and one, J, in gear with a small intermediary pinion L; the latter gears with a spur wheel K keyed on one end of an upper short shaft G. At the other end of this shaft is keyed a clutch, H, while between K and H is loosely mounted a special pinion F. Both the pinions M and J are mounted loosely on the motor shaft N, they only driving their respective spur wheels when in contact with the clutch A

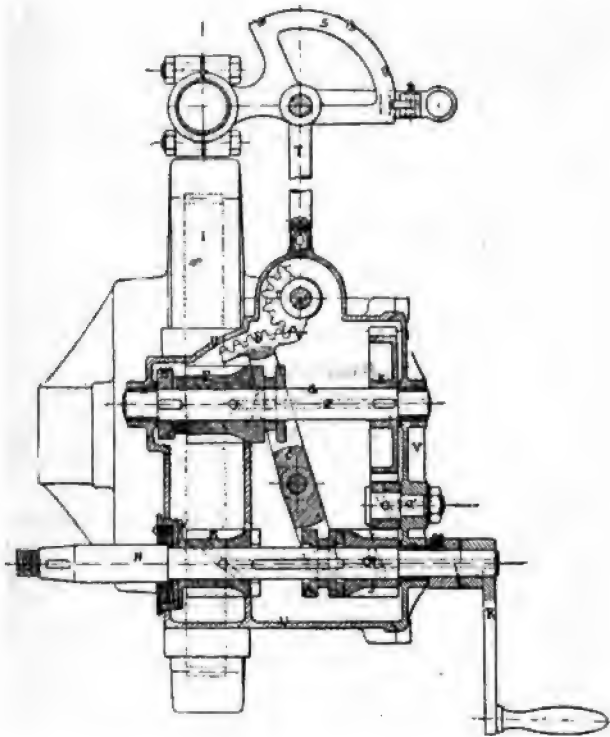


FIG. 1.

keyed on, but free to be moved along the motor shaft N between them. The lever C is so arranged as to control the movements of both the clutch A and the pinion F, its movement being effected through the toothed segments E D, lever T, and handle B. The illustration, Fig. 1, shows the position of the gear to give the slow speed; the lever C has been moved over, causing the clutch A to make rigid contact with, and so drive, the pinion J; while the clutch has thus been moved along the shaft to the right the pinion F which runs loosely on the shaft, has been gradually made to mesh with the spur wheel I on the axle, and it is only when the pinion F is fully in gear with I that it makes contact with the clutch H, so causing the power of the motor to be transmitted to the wheel I at a reduced speed. To allow the machine to travel

at the normal speed of the motor, the clutch A, by means of the lever C and its connections, is released from the pinion J—the pinion F being simultaneously withdrawn out of gear from the wheel I—and brought into contact with the pinion M, so

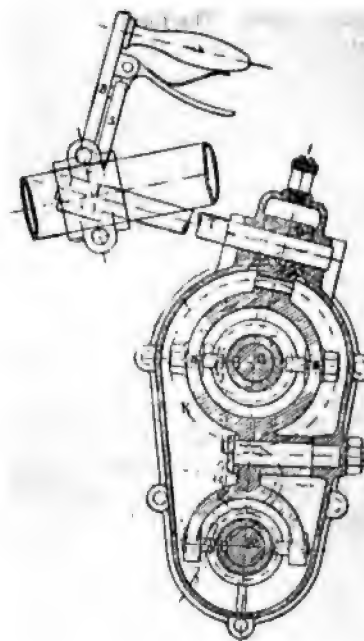


FIG. 2.

causing the latter to drive the wheel I. The speed-controlling handle is attached to the top bar of the frame of the tricycle; a sector with four notches is also provided in connection with it, the respective positions being: (1) slow speed, (2) slow speed gear half withdrawn, (3) both gears out, motor running free, and (4) high speed. M. Dupressoir has taken advantage of the provision for the motor to run free from the transmission gear by providing a handle by means of which the motor may be put in operation before mounting the tricycle, so rendering the use of the pedals unnecessary.—*Motor Car Journal*.

The Motor Repair Shop.

A motor vehicle mechanic is not necessarily an electrical engineer, yet he must care for electrical apparatus and at times make certain repairs and adjustments. In the care of motors the essential thing is to have all screws, bolts, bearings and parts in place and in perfect alignment. Heating of bearings may occur, or the journal may so bind as to cause loss of power. Sometimes this is due to dirt or sediment, made chiefly by the iron ground out from the bearings. Part of it is also due to the sediment contained in the oil, which varies with the grade of oil used. Bearings that are not properly oiled, and run partly dry, grind out a great deal of metal at times. Whatever its nature this dirt has a bad effect, as it thickens the lubricant, thereby consuming power. It can be prevented by liberal use of oil at the start, when the wear is most serious, thereby flooding it out. The other method is to remove the shaft and bearings and clean the base with a swab. Heating of the bearings is usually due to high currents in the coils, short-circuited armature coils and excessive moisture. High currents in the field circuit will cause the field magnets to heat. Sparking occurs even in the most perfectly designed

machines, and is due to a bar shifting its position, rough commutator, irregular contact of brushes, too much load on armature, or broken circuit.

Knocks are due to loose collars, set-screws, journals, vibration of armature, slipping of belt, machine overloaded and a short circuit in armature. The form of vibration in the armature is entirely different from the harsh jar arising from a crooked or imperfect shaft, or a spindle construction which does not allow sufficient yield in the bearings.

MAKING NEW BRASSES.

The motor vehicle mechanic is often called upon to make a new set of brasses. The brass boxes are bored to fit the shaft, but when removed from the chuck and placed on the motor shaft it will be seen that the contact is not correct, due to the unequal cooling of the metal. This is explained in Fig. 1. Instead of trying to make a forced fit cover the surface of the

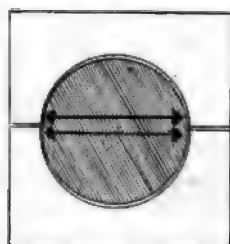


FIG. 1.

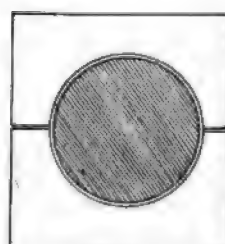


FIG. 2.

shaft with colored chalk, turn the shaft and file and scrape those parts of the brasses that take the markings. This should be repeated several times, until a true fit is obtained, as in Fig. 2. Avoid a tight fit, as there should be room for films of oil to form around the bearing for lubrication. A shaft running with a moderately loose bearing fit, a loose band or a low speed, does not usually run so steadily as under the opposite conditions, although when performing work the eye may not be able to detect the motion. Still, it is preferable to take the chances with an average loose fit than with a tight fit.

TUBING TROUBLES.

It so happens at times that the tubing of a motor vehicle frame is not sufficiently strong in itself to bear the pressure of a set screw of a clamp, and the point of the screw makes a depression in the tube wall as at (a) Fig. 4. To fix this,

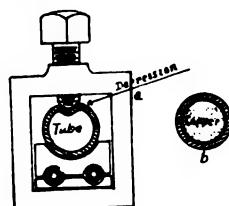


FIG. 4.

straighten the dented place and fill the depression in the tube with a piece of some soft metal, as copper, and screw the set screw down onto that until the clamp is sufficiently tight. The copper plugged section is shown at (b).

USEFUL MEASURING TOOL.

In Fig. 5 is a diagram of a tool consisting of a steel gauged shaft E, on which are adjustments C C, each of which are

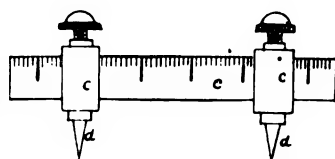


FIG. 5.

fitted with set pins and pointed at the lower ends, as shown at D D. The tool can be easily made, and will be found useful in making measurements of cones, cone shafts, cone cups, disks and other parts of the mechanism.

SOLID LUBRICANT INJECTOR.

It is often desired to force solid lubricant into bearings without taking them apart. To make this an easy and cleanly operation an injector is necessary. One of these may be made from a common single action hand pump. Fig. 6 is a longitudinal section of a completed injector made in this way. The



FIG. 6.

outer end of the piston rod should be fitted with any kind of handle that will allow pressure to be put on that end without hurting the fingers. Take the nozzle off one of the oil cans commonly used in paper mills and drill a hole in the bottom of the pump barrel just large enough to take the base of the nozzle. Solder this in and the injector is complete. Fill the barrel with the lubricant used by taking off the cap and pulling piston out.

MINOR MENTION.

The Cincinnati Omnibus Co. has ordered two electric vehicles, which will be tested on the stiff hills thereabout.

Joseph J. Mandery, Rochester, N. Y., has taken the local agency for the electric vehicles of a Chicago manufacturer.

A company with \$50,000 capital is to be organized to run a stage line from McKee's Rocks to Pittsburg, Pa. The stages are to carry twenty passengers.

The Morse-Keefer Co., Salisbury, Conn., will make a specialty of swaged wire spokes and swaged and tapered tubing for motor vehicle manufacturers.

The real estate, machinery and fixtures of the Columbia Automobile Co., Hartford, Conn., have been transferred to the Columbia & Electric Vehicle Co. for \$139,000.

On Saturday the Riker Electric Vehicle Co. was incorporated in New Jersey, with a capital stock of \$7,000,000. The incorporators are Andrew L. Riker, Wm. G. Meyer and James C. Young.

The new syndicate which has purchased a controlling interest in the Daimler Manufacturing Co., Steinway, L. I., will make a specialty of heavy work wagons, including brewery, coal and express wagons.

It is reported on good authority, that the Columbia Electric Vehicle Co., of Hartford, Conn., is negotiating for the purchase of the plant of the New Haven Carriage Co., New Haven, Conn., who have been building carriage bodies for them for several years.

It is reported that steps are being taken to place electric vehicle charging hydrants, such as were shown at Madison Square Garden recently, in a number of livery stables in different parts of New York City. Charging facilities have been arranged at the Edison Duane street station.

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 626,611—Expansible Lubricating-Piston—Walter Hay, Seville, O., assignor of one-half to Emerson M. Hotchkiss, Waterbury, Conn. Application filed April 30, 1898.

This invention relates to improvements in trunk-pistons, which are more particularly intended for use in connection with explosive motor cylinders; and the objects of the improvements are, first, to provide for a suitable lubrication of the pistons, (cylinders, respectively;) second, to render the pistons expansible with regard to fitting the wall of such cylinders, and, third, to provide suitable means for such purposes which are most efficient and durable in operation.

Fig. 1 represents a longitudinal part sectional and part exterior view of a piston embodying the features above alluded to; and Figs. 2, 3, and 4, respectively, represent transverse sectional views on lines x x, y y, and z z.

The illustration of the piston herewith given substantially comprises the frame A, the semicircular casings B B and C C, the fillers D D, and the springs E E.

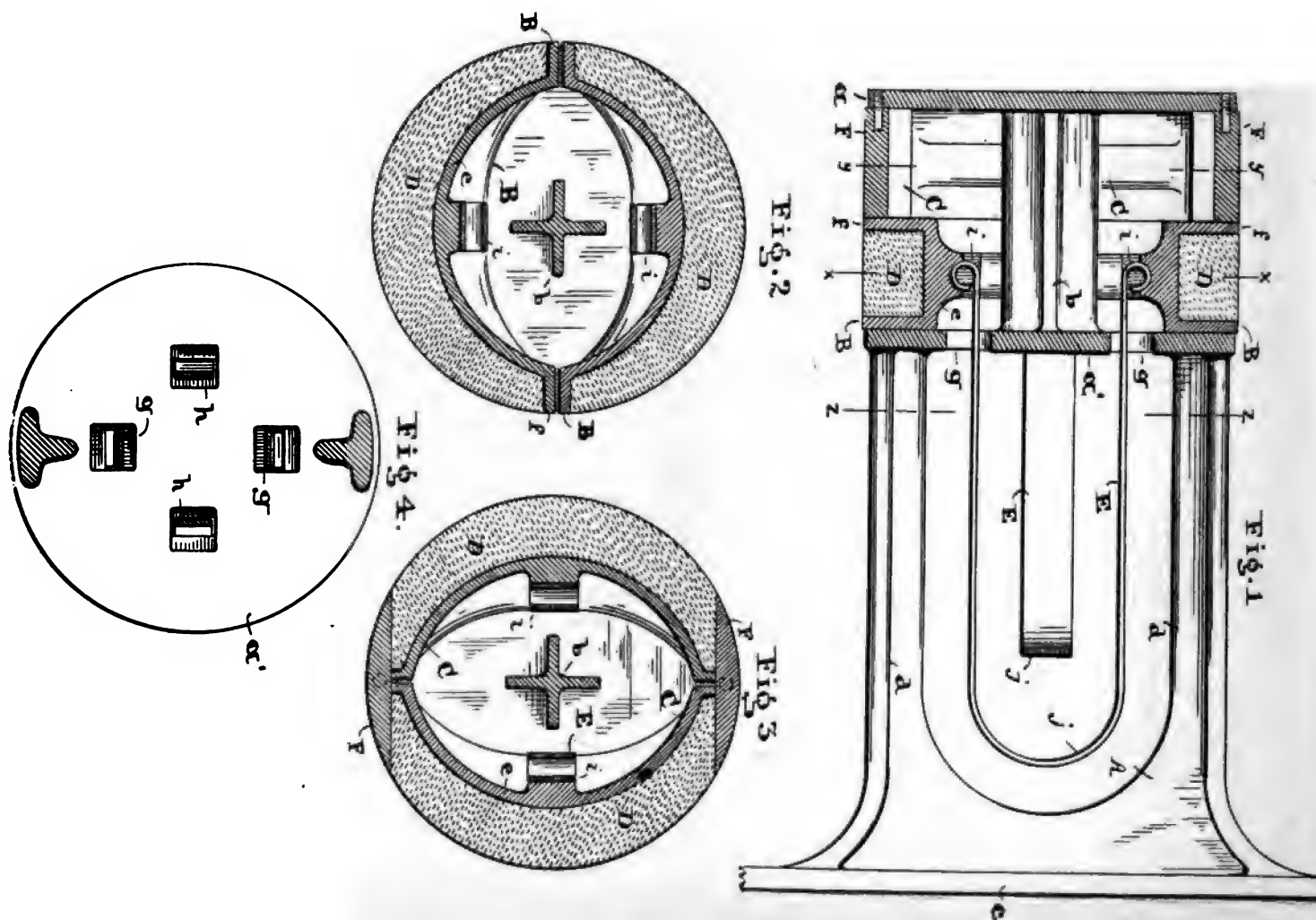
Circular plates or disks a a constitute the piston-terminal of the frame A, the outer plate a of which is held secure and concentric in connection with the inner plate a' by means of the core b. (See Fig. 1.) As shown, the outer terminal c of the frame is adapted for a yoke connection with a crank-shaft or equivalent.

It is obvious that the sides d d be of such form as to embody greatest resistance in a comparatively light structure.

The casings B B and C C, consist of the arch-plate e and the flanges f f. The casings are of corresponding width, so as to fit closely between the plates a a.

The fillers D D are prepared of suitable lubricating ingredients and compressed into the solid state to suit the cavity of the casings. (See Figs. 1, 2, and 3.)

The springs E E are of an elongated return form in preference, flat steel being used for the purpose of forcing the casings with contents against the wall of the cylinder. Through the ports g g and h h admission is had for the springs into the piston proper. The ports also serve in the nature of guides for the purpose of retaining the casing and springs in about the relative position as shown. Any suitable mode or form of connection may be adapted for the purpose of retaining the terminals i of the springs in operative connection with the casings. (See Figs. 1, 2, and 3.)



It is intended that the casing-joints relatively should be about at right angles in order to effect a uniform expansion of the casings around the cylinder-wall, also to prevent leakage past the joints.

Auxiliary blocks F are employed in connection with the front casings C C. These blocks cover the joints of the casings and admit of the expansion thereof under exclusion of exposure of the joints. (See Figs. 1 and 3.)

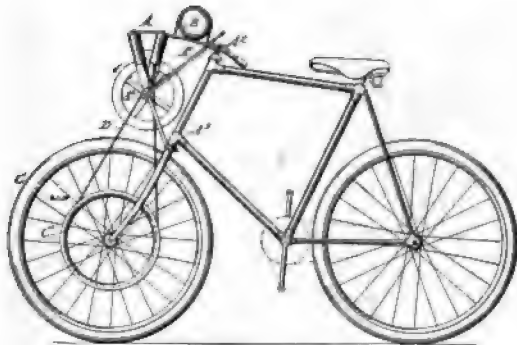
The piston is rendered self-lubricating owing to the lubricating consistency of the fillers D D. The material of which the fillers are made is sufficiently hard in nature to answer the purpose of making tight contact with the cylinder-wall in order to prevent leakage past the piston.

The form and position of the springs admit at all times of inspection thereof and a ready adjustment, if necessary. Furthermore, the active part (loop j) is so far removed from the heat of the cylinder that from this source no injury can be done to the springs.

It is obvious that the frame A of and for the piston may consist of an integral skeleton formed substantially as shown, or a structure answering the same purpose may be constructed of more than one part without departing from the nature of the invention.

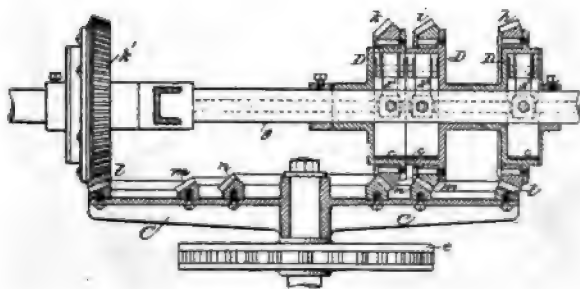
Claim.—A piston consisting of a frame of which one end terminates in separated disks, two or more sets of casings, lubricating-fillers carried by said casings, which fit between said disks, auxiliary blocks for the outer set of said casings, and elongated return-springs extending through ports in the inner disk and being in operative connection with said casings all constructed and arranged substantially as and for the purpose set forth.

No. 626,295—Motor Attachment for Bicycles. Edward J. Pennington, Walton-upon-Thames, England. Filed December 30, 1897. Serial No. 664,734. (No model.)



Claim.—The combination with a bicycle, of a motor, a frame carrying the motor and detachably fastened to the steering-frame of the bicycle, and means for driving the steering-wheel from the motor.

No. 626,735—Motor Vehicle—Hugo Stommel, Plainfield, N. J. Application filed July 9, 1898.



Claim.—In motor vehicles, the differential gear described, consisting of bevel pinions provided with hollow drums containing pivoted arms, actuated by rods having bulbs for forcing the arms and the spring against the interior of said drums, and the rods moved longitudinally by a nut and screw, receiving motion by gearing and a vertical shaft with handwheel, arranged at the front of the vehicle.

No. 626,996—Power Transmission Apparatus—John William Hall, London, England. Application filed June 21, 1897.

This patent was described and illustrated in THE HORSELESS AGE of April 12.

No. 626,967—Transmission-gear for Motor-vehicles—William Cook, Philadelphia, Pa. Application filed March 7, 1899.

Fig. 1 represents a vertical section of a transmission-gear embodying the invention, including a portion of a vehicle to which it is applied. Fig. 2 represents a partial side elevation and partial vertical section on an enlarged scale. Fig. 3 represents a top or plan view on an enlarged scale. Fig. 4 represents a partial side elevation and partial vertical section on line y y, Fig. 3. Fig. 5 represents a section of a portion on line x x, Fig. 1.

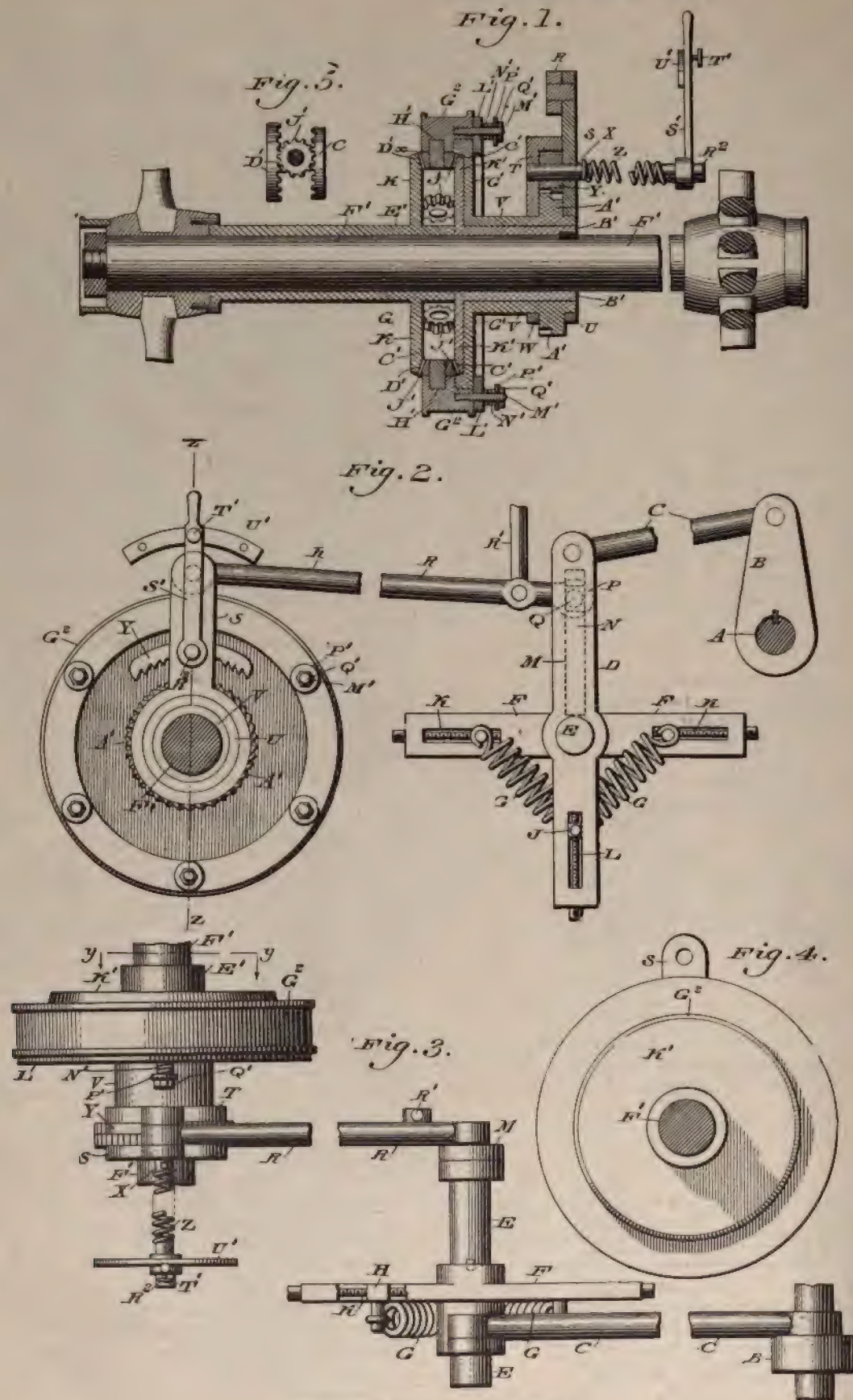
A designates the shaft, to which the power of the motor on the vehicle is imparted. B designates a crank-arm, which is keyed or otherwise secured to the shaft, and has pivotally connected with it one end of the rod C, whose other end is pivotally connected with the rocking arms D, freely mounted on the shaft E, the latter having its bearings on the vehicle. Keyed or otherwise firmly secured to the shaft E are the rocking arms F, to which are attached the springs G G, which are also attached to the arms D. It being noticed that said arms D and F are provided with nuts H J and screws K L, the springs being attached to the nuts, so that by the proper rotation of the screws, which are mounted on the arms and engage the nuts, they serve to adjust the tension of the springs.

Secured to the shaft E is the rocking arm M, which is provided with the longitudinal slot N (shown in dotted lines, Fig. 2,) the slot receiving the block P, on which is the pivot Q of the rod R, the latter being provided with an arm R₁, whereby the rod may be raised or lowered on the rocking arm M, so as to adjust the throw of the rod R, and consequently of the reciprocating lever S to which it is pivoted, the lever having connected with it the arm T and being provided with the boss U, which freely encircles the sleeve V, said arm T being provided with the boss W, which also freely encircles the sleeve.

Mounted on the lever S and arm T is the rock-shaft X, which carries the double-winged pawl Y, adjacent to which is the ratchet A₁, secured to the periphery of the sleeve V, it being noticed that the ratchet has two rows of teeth pitched respectively in opposite directions, the teeth of the pawl Z being also reversely pitched at the opposite wings or ends thereof.

The sleeve V freely encircles the hub B₁ of the bevel-gear C₁, opposite to which is the bevel-gear D₁, which is provided with the hub or sleeve E₁, which freely encircles the axle F₁. It being noticed that one wheel of the vehicle is secured to the axle F₁ and the other to the sleeve E₁, as its axle, the sleeve being sustained by the portion of the axle F₁ extended into the same, the wheels thus being carried by the sections of a divided shaft or axle.

On the inner end of the sleeve V is the ring G₁, whose periphery is clamped to the rim G₂, on whose inner face is the inwardly-projecting stud H₁, on which is mounted the bevel-pinion J₁, which meshes with the bevel teeth or gears C₁ D₁, on the inner side of the peripheral portions of the pinions K₁



TRANSMISSION OF WILLIAM COOK.

and K, the pinions being formed with or otherwise secured to the hub B1 and sleeve E1, respectively.

In order to secure the ring G1 to the rim G2, the annulus L1, the studs M1, the springs N1, the washers P1, and nuts Q1 are employed, the studs passing through the annulus and rim and the springs being interposed between the washers and annulus, the washer being retained in position by the nuts Q1 on the outer end of the studs, thus forming a slip-joint for the rim and the sleeve V.

The shaft X, which carries the double-ended pawl Y, has secured to it the coil-spring Z, whose outer end is connected with the stud R2 of the hand-lever S1, the latter carrying the pin or screw T1, which is adapted to enter either of the openings of the segment U1, so that when the lever is rotated the spring Z acts by torsion to turn the pawl Y into contact with either row of teeth of the ratchet A1 relatively to the direction the vehicle is to be propelled forward or backward.

The operation is as follows: As the shaft A rotates, its motion is imparted to the crank B, thus oscillating the arms D F M, the rod R, and the arm S, it being noticed that the springs G, which receive motion from the arms D, impart the same to the arms F in an easy and gentle manner, avoiding jerking or severity in the motion of the shaft E. The pawl Y, which is carried by the oscillating arm S, now operates the ratchet A1, so that rotary motion is imparted as one to the sleeve V, the pinion K1, the rim G2, the pinions J1, traveling with the rim, the two gears C1 D1, the limb B1, and the axle F1, so that the wheel on the latter is rotated, rotary motion being also imparted to the hollow shaft or sleeve E1, and thus to the wheel connected with the latter, whereby the vehicle is propelled. When the vehicle turns a corner or makes a curve or either wheel strikes an obstruction, the wheels may move at different velocities or independent of each other, since either pinion K1 or K may rotate without being controlled by the other, and thus there is no strain on either gear, and consequently on the vehicle-wheels.

Should from any cause severe strain be imparted to the rim G2, the ring G1 may slip therein, thus avoiding fracture of the ratchet A1, the pawl Y, and connected parts.

No. 627,066—Automobile—John Schnepf, New York, N. Y., assignor of one-half to William C. Doscher, same place. Application filed May 6, 1898.

In the drawings, Fig. 1 is a side elevation of a bicycle provided with my improved apparatus. Fig. 2 is a relatively enlarged plan view of a detailed portion of my invention. Fig. 3 is a side elevation of Fig. 2.

A is a battery of any suitable portable type, detachably supported in the forward inside portion of the frame of a bicycle by suitable fastening-clamps a a.

B is a motor, mounted in a suitable frame carrying forwardly-projecting arms D D, having semicircular depressions d d near their outer ends.

E is a frame a portion of which lies parallel and close to the arms D. The frame E projects beyond the ends of the arms D and is then turned inwardly and again bent toward its extreme forward end into the circle e. This circle is divided, so that the forward ends of the frame E may be sprung apart. A wing-nut or other suitable fastening device e1 is provided to clamp the divided ends of the frame E near its forward end. Wing-nuts d1 may be provided near the free ends of the frame D to draw the said frames D toward the frame E.

In Figs. 1, 2, and 3, F is a pulley, preferably grooved and carried by the armature B1 of the motor B, the pulley being arranged so as to rotate herewith. Suitable electrical connections G between the battery A and the motor B are pro-

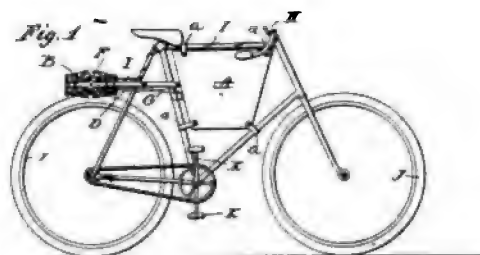


Fig. 1

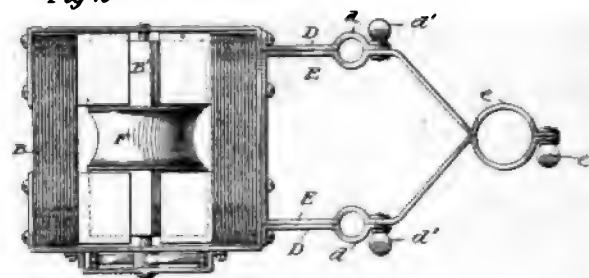
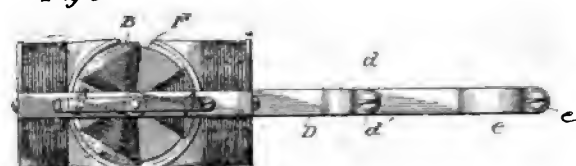


Fig. 2



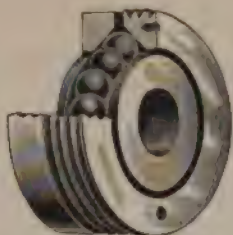
vided. Likewise a suitable controlling means H is connected, as at I, with the circuit to regulate the flow of electricity through the motor. This controlling means is provided with a suitable detachable fastening, so that the same may be detachably secured to the frame of the bicycle at any suitable point.

In assembling, battery A is secured to the bicycle-frame. The motor B, through the medium of the frame E, and D, may be clamped to the bicycle-frame so as to cause the pulley F to bear upon one of the bicycle-wheels J, preferably the rear or driving wheel. The controlling means H is then clamped to the handle or to any other suitable portion of the frame which is readily available to the rider. The connections G and H may then be made. When the parts are thus attached, the rider may at will allow the current to pass through the motor, energizing the magnets and rotating the armature in the usual way. The rotating armature B1 causes the pulley F to rotate, and the same bearing frictionally upon the driving-wheel J, drives the latter.

Because the pulley F and the wheel J are relatively small and great, no great amount of power is required to revolve the armature, the same being determined by the relative sizes of the said pulley and wheels. As the motor has a capacity of very high speed, a sufficiently high speed may be transmitted to the driving-wheel J.

The rider may readily employ the aforesaid driving means as the sole source of power, or, as supplemental power, the pedals K K being at all times available for use. When the rider encounters a decline, the motor may be thrown into contact with the driving-wheel J and utilized as a dynamo to restore the battery A. It will be understood, of course, that the battery is usually charged from an outside source.

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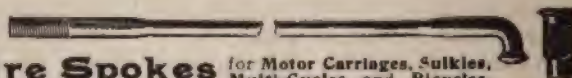
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VOLUME 4

JUNE 28, 1899

NUMBER 13

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THE EVOLUTION OF THE MOTOR VEHICLE AS SHOWN BY PATENTS.
By Leonard Huntress Dyer, p. 7.

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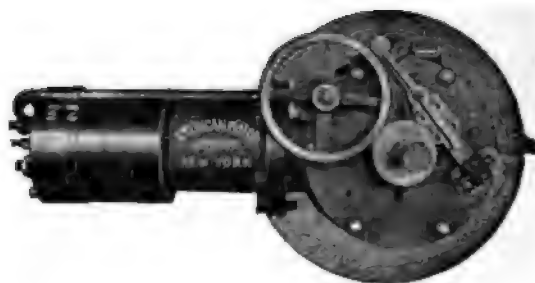
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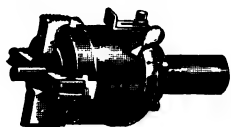
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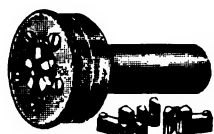
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VOL. IV.

NEW YORK, JUNE 28, 1899.

No. 13.

THE HORSELESS AGE.

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Honest Horse Powers.

Exaggeration is a common failing of industrial promotors and pioneers. It seems to be necessary in the established order of things that the launching of new enterprises and the founding of new industries should fall to the lot of men of decidedly rose-colored vision. The motor vehicle industry is no exception to this rule, a good example of which is seen in the tendency to overrate the horse power of gasoline motors and the capacity of storage batteries.

The horse power of a gasoline motor, other things being equal, is easily determined by the diameter of its cylinder or cylinders and the length of its stroke. The capacity of a storage battery is a somewhat more complicated question.

The same overrating of gasoline engines is customary in the launch business. A manufacturer of marine gasoline motors, who believes in honest horse powers, recently told the editor that his 6 H. P. motors were running away from

other makers' 10 and 12 H. P. (?) motors right along, and that competitors could not understand why he rated his motors so low, when, as a matter of fact, his engines were rated by actual brake tests, while his competitors' were rated in direct contravention of the laws of thermo-dynamics and of veracity. To such a state of demoralization have we been reduced by a foolish and short-sighted business rivalry, that the term horse-power now has no definite meaning in these industries. The proper corrective in the gasoline motor industry would be to establish the custom of mentioning the cylinder dimensions in catalogues and other printed matter from which the real horse power developed may readily be computed according to known laws.

As to the capacity of storage batteries for vehicle use it is rather early to get reliable published data.

Authorities Relenting.

The opposition of park commissioners in New York and Chicago to the motor carriage is already on the wane. The overwhelming tide of criticism that rose in the press throughout the country at the action of the commissioners in Chicago must have convinced these gentlemen that public sentiment was not with them. The New York commissioners have also been so far influenced by the general clamor and by the organization of the Automobile Club of America in New York, as to listen to petitions for the admission of motor carriages to Central Park. It is the beginning of the end of opposition, and the end is not far off. The history of the bicycle will *not* be repeated in the case of the motor vehicle. The world has advanced in its ideas of locomotion in the past fifteen years. The bicycle itself has been an educator, and the motor has been so thoroughly advertised in all Christendom that the great majority of the people believe in it. The prejudice against it is certainly not at all comparable with that which the bicycle encountered in its early period. The

dawn of the twentieth century marks a new era in locomotion, and the wheels of progress are rapidly accelerating as we enter upon it. With the exception of a few old fogies who will be swept along by the procession—the world is with the promoters of the motor vehicle.

Investigate.

In referring our readers to the very instructive article on "The Evolution of the Motor Vehicle as Shown by Patents," which Leonard Huntress Dyer contributes to this issue, we lay particular stress on a well-known fact therein brought clearly to light—namely, the blindness of the average inventor to the history of the art he undertakes to improve, and his contempt for the labors of others antecedent to and contemporary with himself. Probably nine-tenths of the time and money wasted on inventions could be saved if inventors would hold their enthusiasm in check long enough to study the work of their predecessors in the patent records. A cursory digest of this history has been prepared by Mr. Dyer, and he will furnish it serially to *THE HORSELESS AGE*, taking up one by one the principal parts of the motor vehicle, and showing the progress of the inventive idea up to the present preferred forms.

Evidence is not wanting that some of our capitalists, suddenly awake to the possibilities of the motor vehicle industry, are taking it up with insufficient investigation, on mere hearsay, or under the guidance of engineers, well versed, perhaps, in other lines, but imperfectly informed on the complex problems that now confront the motor world. To those who have given little thought to the question it seems an easy matter to build a "horseless carriage," and so it is, to build a carriage whose chief distinction from the horse carriage will be that it lacks a horse, but to build practical motor vehicles of the thousand and one types required in service to-day is one of the most difficult problems that has taxed the mechanical mind.

Engineers who understand the motor vehicle are few; capitalists who understand it are few. When both capitalist and engineer are ignorant of the subject the business combination is not apt to result fortunately. Let those who are inventing or investing in this new field take a broad survey of it before venturing. It is full of promise, but it is also full of pitfalls.

Criticism Invited.

The organizers of the New York-Irvington Road Contest announced in our last issue, invite a free expression of opinion from all interested in motor vehicles on the code of points suggested by them. This code is subject to revision at the discretion of the judges—General Miles and his associates—who join with Messrs. Walker and Barber and the editor of *THE HORSELESS AGE*, in urging automobilists to criticise

freely the published code in order that a satisfactory consensus may be arrived at as soon as possible.

We are all looking for light on these new subjects and a mutual interchange of ideas will be to the common advantage.

Angle Steel in Motor Vehicle Construction.

The relative advantages of tubular and angle steel for motor vehicles are likely to be considerably discussed in the near future, and we refer our readers to an article on this subject on another page of this issue. The author, Mr. Clegg, offers a number of very useful data in reference to the comparative merits of the two kinds of material, but overlooks a very important point of superiority in angle steel for this special purpose, and that is, that the greatest strength of the metal may be brought in line with the greatest strain if angle steel is employed. If the strains are downward or vertical, the steel may be laid like beams that support a floor; if the strains are chiefly lateral, however, as is true of some parts of the motor vehicle frame, the material can be turned the other way, so that the resisting force will be greatly increased. These advantages of angle steel seem to give it the preference for many parts of the framework, of heavy vehicles in particular, and it is now being used for this purpose by some of the leading manufacturers.

Winton-Charron.

This much-talked about race seems to have been entirely abandoned, and as no other American manufacturer is in a position at present to cope with the latest French racing machines, the whole matter will probably be dropped, especially since the \$2,000 racing cup of the Automobile Club, of France, has put the subject of international racing on a different plane.

The conditions under which the trophy is to be competed for are not clear, but we shall know more of these in a few days, and as automobile clubs the world over are composed of gentlemen who look with disfavor on the mercenary side of sport, the whole atmosphere may be said to have been cleared by the action of the Automobile Club of France.

New York Automobile Club.

A meeting of the organizing committee of this new organization was held at the Waldorf-Astoria last week Tuesday. The name originally adopted—Automobile Club of America—was changed to the above. George F. Chamberlain, temporary president was requested to prepare a certificate of incorporation and attend to the necessary legal duties connected with the filing of it.

Another meeting to discuss the constitution and by-laws will be held this week. The address of the club until September 1, is Waldorf-Astoria Hotel.

The Evolution of the Motor Vehicle as Shown by Patents.

By Leonard Huntress Dyer.

PART I.—THE COMPENSATING GEAR.

An examination of the patents contained in the classes which the patent office has established to cover the field of the motor vehicle industry brings many interesting and instructive things to light.

The problem of the motor vehicle appears to be a simple one. When the steam engine became known, the idea must have occurred at once to numerous engineers to use this means for driving a coach or carriage upon the common roads. As in all undeveloped arts the difficulties which were anticipated were underestimated. It was soon found in practice that the simple attachment of a steam plant, using well known devices for connecting it to the drive wheels of the carriage, did not produce a working machine. Some practical way had to be devised for connecting the engine to the driving wheels.

The records of the Patent Office show that at a very early date many parts of the motor vehicle were mechanically perfected. The earlier patents show and describe devices of the crudest and simplest kind, but by examining those which followed, it is seen that many problems which first confronted the inventor were overcome by a chain of developments, carried through by successive steps to a successful termination.

The successive links in the chain of development are shown in a considerable number of patents, both in America and abroad, but chronologically the chain is not perfect, as several of the earlier patents show well developed and practically perfected means for attaining the desired end; while, on the other hand, some of the patents of quite a recent date show devices which earlier inventors had used and discarded.

This would seem to indicate that the earlier patents were not carefully studied by inventors working subsequently, for had this been the case, many comparatively recent patents would not have contained matter which was shown and described in early patents and discarded, and other means substituted in later patents.

One of the most interesting of the series of developments lies in the driving gear. Some of the earlier patents show but a single rear, driving wheel, the engine being connected to it by means of cranks and connecting rods. This was early abandoned in favor of the four-wheeled vehicle, two of the wheels being driven. The wheels were keyed upon the extremities of the axle and motion was imparted to the latter by means of integrally formed cranks thereon; connecting directly with the engine as in the inside connected locomotive, or by using an engine of the stationary type, and connecting its shaft to the drive shaft by means of a train of gears, or by sprockets and chains.

The patent to R. H. Long, No. 26,911, January 24, 1860, shows that even at this late date this simple improvised means for driving was thought practicable enough to be described in a patent. Moreover, this inventor describes this as if he thought it were new and operative. It had no doubt been found faulty in practice before this date. The wheels being rigidly keyed to the axle, if a curve were attempted to be negotiated, difficulties would be immediately

encountered. The wheel on the outside curve would describe a circle of greater circumference than that upon the inside, but the wheels turning together at the same rate of speed, one or both would have to slip upon the ground, causing an increased resistance to the forward motion of the vehicle, and at the same time would render an upset possible.

This difficulty was overcome at an early date by keying only one of the wheels to the axle, the other turning loose thereon and doing no work. This I find described as new in a patent as late as the 10th of March, 1868, to N. S. Bean, No. 75,348, in which the inventor states that he prefers to drive the vehicle with but one of the driving wheels, the other being loose upon a rotating axle; keeping the vehicle to its course by means of the steering wheel. Upon good level roads this plan was no doubt successful, but when hills or bad roads were met with, the driving wheel being to one side of the center of the vehicle, it must have caused the carriage to swerve to one side. In the patent to J. S. Hall, No. 16,919, March 31, 1857, this difficulty was recognized and overcome, for while one wheel was rigidly keyed to the moving axle, the other wheel was secured thereto by means of a jaw clutch, operated by a lever arranged to one side of the driver's seat. By this means in climbing hills the extra wheel could be keyed to the shaft and would turn with the fixed wheel, but upon curves, the clutch would be disengaged and would allow the two wheels to turn at different rates of speed. This probably worked all right when turning the curve to the side of the clutched wheel, but when turning the other way the resistance must have been excessive and the danger of overturning great.

This obstacle was overcome by attaching both wheels by clutches and arranging the operating levers one to each side of the operator. The British patent to Alexander Richard McKenzie, March 20, 1865, No. 780, clearly shows this construction of the device. The two wheels are separately driven by means of chains and sprocket pinions attached to the extremities of the counter-shaft. The latter is made in three parts, the central part being connected to the engine by means of gears. The two outside parts of the counter shaft are connected to the central portion by means of jaw clutches. The latter are operated by means of hand levers, one arranged on each side of the steerer's seat. By this device, upon a curve being attempted, the clutch controlling the motion of the inside wheel could be disengaged and the work thrown entirely on the outside wheel. This device must have been cumbersome in action on account of requiring additional separate motions on the part of the steersman.

The next step in the development of the device was to automatically disengage the clutches when making a turn. This was easily accomplished by connecting the clutch levers by links to the steering handle. The patent to E. C. Jones, No. 17,070, August 11, 1857, describes and shows a full and complete means for accomplishing this end. In this patent, the driving wheels are secured to the rear axle by means of jaw clutches. The front axle upon its fifth wheel carries a rack which engages with a pinion attached to the lower extremity of the steering pillar. A lever carrying a sector rack, having teeth upon its forward face, is pivoted to the bottom of the carriage and engages with the same pinion, while links connect this lever to the operating members of the clutches. In operation, upon the steer-

ing handle being turned to one side and deflecting the front axle to one side, the sector lever would be correspondingly turned which would disengage the clutch controlling the inside wheel. This seems to be the final step taken in the development of disengaging jaw clutches for this purpose.

The difficulty of allowing the driving wheels to turn at different rates of speed upon their axles was solved and perfected by other means. Instead of connecting the wheels to the axles by means of jaw clutches, which would require positive means for their disengagement, at an early date ratchet clutches were used which would automatically allow the inside wheel of the curve to drive and the outside wheel to outrun. The patent to J. W. Hazen, No. 113,767, April 18, 1871, shows a simple device of this character. In this invention the two driving wheels are connected to the axle by means of simple ratchet clutches. Among other disadvantages, this device would not allow the carriage to run backwards as the ratchet dogs would idly slip over the teeth of the ratchet clutches.

This was overcome in the patent to F. Alger, No. 115,802, June 13, 1871. This device may be described as follows:

The rear axle turns in boxes attached to the centers of the rear supporting springs. The rear wheels are not rigidly fixed to the axle, but are so arranged that they revolve independently upon it. The center of the axle is formed with two cranks at right angles to each other to which are attached the connecting rods of a horizontal engine. A disk is keyed rigidly to the axle adjacent to each wheel. Notches are so arranged upon the periphery of the disk that one of the short arms of a lever would engage with its corresponding notch. The levers are each pivoted, at the point of intersection of its arms, to one of the spokes of a drive wheel. A suitable spring is attached to the same spoke and engaging with the long arm of the lever will cause the proper short arm to engage with the corresponding notch upon the disk. If the spring is set upon the proper side of the lever, its action will cause the wheel to turn in the right direction, but if the spring is reversed, that is, put upon the other side, the lever and disk will rotate in the opposite direction. The object of the lever and disk is to allow one wheel to go faster than the other, as it has a tendency to do as the carriage is being turned; thus if the carriage is going forward the wheel inside of the circle will be driven by the axle and carry the vehicle along, but the wheel on the outside will revolve faster than the axle. This it will be free to do, as the lever will be carried backward over the notches in the disk. To drive the vehicle backward it is necessary for the operator to get out and shift each of the springs to the opposite sides of the levers.

As described in connection with the jaw clutch, any device which made the inside wheel the driving wheel met with excessive resistance upon curves and at the same time caused more or less danger of upsetting. The patent to J. M. Lauck, No. 183,177, October 10, 1876, was designed to overcome this objection. The rear axle, which is the driving axle, turns and the wheels are turned thereby by means of spring engaged ratchet clutches. These means are shown as consisting of levers arranged one on each side of the operator's seat. In turning ordinary curves, that is, curves of large radius, the outside wheel would slip upon the axle by its clutch overriding, the work therefore being done by the inside wheel. The clutch, of course, would

slip automatically without any attention on the part of the steersman. In turning short curves, however, the clutch connecting the inside wheel with the axle is manually disengaged, thus putting the burden of driving upon the outside wheel. This invention was perfected by connecting the clutch lever with the steering device, so that they could be automatically disengaged in turning sharp curves. This perfected system of clutches and ratchets has apparently been entirely abandoned in practice to-day, except, perhaps, in some form of traction engines. Three mechanisms have supplanted it, the differential, the twin motor and slipping friction connections.

The history of the differential begins, from the standpoint of the Patent Office, June 16, 1857, at which date British patent No. 1,684, was applied for by John Fowler, Jr., together with Robert Burton and Thomas Clarke. In this patent is described and illustrated a traction engine using upon its driving axle a differential or jack-in-the-box of almost exactly the same design and construction of those in use at the present day. In this invention one of the bevel gears is keyed directly to one of the driving wheels, the other is keyed to a sleeve surrounding the axle and supporting the other driving wheel. The frame supporting the internal gears is keyed to the axle and rotates with it, the wheels, of course, being mounted loosely thereon. This patent could not have been very well known in this country for a patent was granted to N. S. Bean, December 22, 1874, No. 157,904, showing and describing almost identically the same thing.

As the employment of the differential upon the driving shaft has been found in modern use to have certain mechanical disadvantages, at a comparatively early date patents were granted showing the use of the differential upon the counter shaft and two chains or two sets of gears independently connecting the rear wheels. Very good examples of this construction are found in the patents to F. E. Culver, No. 212,839, March 4, 1879, and H. H. Brindenthal, No. 212,889, March 4, 1879. From the standpoint of the inventor, this construction was practically perfected twenty years ago.

A radically different method of independently driving the rear wheels was developed simultaneously with the ones just described. This consists in using a separate motor to drive each wheel, the motive power being sufficiently flexible to allow the motor driving the inside wheel of the curve to run at a sufficiently slow rate. The earliest patent I find relating to this is the patent to N. S. Bean, No. 75,348, March 10, 1868. Mr. Bean does not show this in his drawings, but in his specification he informs us that one of his preferred forms of construction is to divide the counter shaft, connect each extremity with one of the driving wheels, and use an independent engine for each half of the counter shaft.

An improvement on this is shown in the English patent to William Henry James, No. 4,957, dated May 15, 1824. In his specification Mr. James points out the difficulty met with, wherein two driving wheels are dependently driven and seeks to overcome it by using an independent steam engine for each of the driving wheels. In order to vary the intake of steam according to the relative positions of the engine, he connected the two throttle valves with the steering gear, so that upon a curve being turned a greater supply of steam could be automatically supplied to the outside engine on the curve. The amount of steam

supplied to that on the inside would be reduced at the same time.

Several patents have been granted at various times which seek to turn the driving wheels independently by the use of friction devices, by means of which different speeds of the driving wheels upon a curve can be compensated for. Various devices were used, such as belts, friction rollers and the like.

The patent to J. G. Wilkinson, No. 53,209, March 13, 1866, connected the counter shaft with the driving wheels by means of a flexible belt which would slip sufficiently upon corners being turned. The patent to L. Walker, No. 193,737, July 31, 1877, shows independent driving wheels having extended hubs against which smooth faced pulleys engaged. The pulleys were carried upon the counter shaft and were forced into engagement with the hubs by means of screws. The patent to G. W. Wade, No. 189,977, April 24, 1877, was an improvement upon this. This inventor used driving wheels having recesses upon their inner faces within which smooth faced pulleys, carried upon the extremities of the counter shaft, engaged.

It is interesting to note that the differential is preferred to-day upon all petroleum driven motor vehicles, and also upon traction engines, while the use of twin motors seems to be a favorite construction with designers of electric motor vehicles. The friction driving connection has been employed in practice upon only one or two modern forms of motor vehicles, and only then upon very light vehicles.

To be continued.

Tubing vs. Angle Steel for Motor Vehicles.

By Robert I. Clegg.

The fact that a firm, which has done much pioneer work in the development of high grade tubing, does not use tubing exclusively for all its motor vehicle frame work, provokes some inquiry as to the relative advantages of the tube and rolled steel of other varieties of cross section. It is not so much a question of material because steel of a grade suitable for tubing is as readily rolled into other shapes, and the several heatings required for the drawbench operations of the one process are probably no more injurious to the quality than the rigor of the rolling treatment. Nor is it likely, for several reasons, a matter of economy as regards the lengths of tubing or angle steel. About the same quantity of both would be used for a frame of like dimensions and the cheapness of the one would be offset by the decreased weight of the tubing.

To my view the all important difference between the two lies in the ease with which the flat surfaces of the rolled sections lend themselves to shop manipulation and design. For example, one need but consider how unhandy a tube really is when an attempt is made to construct a fastening with another piece, which is to be removed occasionally. The tube may be reinforced internally or externally by another tube or a wooden core, and the piece to be attached by a suitable clip and a distance piece fitting the adjacent surfaces. This connection will be satisfactory under circumstances in which rotation around the tube is otherwise provided against. An

example of the opposite character is to be seen in the lower ends of the front forks of a bicycle where the difficulty is met by flattening the tube to get the required surface against which to bolt the spindle. This inconvenience in using the bolts, screws and rivets of modern shop practice would be of little moment where the several parts are as few in number as the bicycle demands, but the case is altogether different in the motor vehicles.

Improvements are being made in brazed joints. The original heavy forgings which were slowly and expensively machined inside and out to the requisite lightness gave way to stampings cut and drawn up out of sheet steel. One maker, if not more, has adopted cast steel for this purpose and, granting due skill in the art of brazing, the tubular frame is as strong and serviceable as it is agreeable to the eye. Unfortunately, the strength of a tube deteriorates rapidly with but a slight injury to the wall. A dent or cut with the corner of a file when the excess borax or spelter is being removed will greatly impair the original resistance. The sand blast is preferable to the file for this very reason, but the readiness of the other accounts for its more common adoption. The injuries alluded to are easily concealed by the enamel and are not readily detected prior to an accident. Where enough of this class of brazing is done, as in a bicycle factory, system and oversight will avoid weakness in this detail, but those who have little of this work to do must therefore exercise the greater vigilance.

Angle steel is readily bent and bolted and affords a good foundation for brackets and bearings. Where a number of bends of equal dimensions are required a steel, or even an iron, die may be cast of the desired curvature. On bending the angle steel around the die—the steel being heated of course—the two webs will diverge from the former right angle. This can be hammered with a flat swage down to the surface of the die whilst the one web is clamped firmly in place. If, the strength of a section of angle iron or steel is calculated from a rectangular form it should not be overlooked that the first has from 2,200 to 4,500 pounds less tensile strength than the latter.

So far as a comparison of the tube and the solid rod is of importance the following is taken from a table published by the manufacturers of Pioneer tubing; a tube having an external diameter of one inch and having a thickness of wall—or gauge—if one tenth of an inch is equal in transverse strength to a solid rod .837 inch in diameter. There is a common belief that steel for frames should be of a very mild, soft nature. During the last few years a better knowledge of the endurance of metals has been obtained from the experiments to determine more accurately the condition to which the term fatigue is applied, and harder and stronger steel is now substituted.

Steel of this type will stand a long continued series of slight bends prior to failure. For example, a 24-inch length of tube is said to have been subjected to quarter-inch vibrations at the rate of 300 a minute night and day for a month, at the end of which time the tube was reported as showing no signs of crystallization or fracture. A tube of $1\frac{1}{8}$ x No. 22 gauge broke under a tensile strain of 10,175 pounds, and a tube of the same quality and size has stood a strain of 6,000 pounds under endwise compression. These figures are decidedly better than I fear much of the common makes of tubing would sustain, and are only here given as an indication of the high grade this branch of engineering has attained.

LONDON NOTES.

LONDON, June 15, 1899.

In a recent issue it was stated in this column that a Yorkshire firm was constructing a motor street sweeping machine. I now learn that Grimsley & Sons, of Holford street, Leicester, are building a motor lawn roller and mowing machine, which is claimed to be particularly adapted to the needs of large parks, cricket grounds, etc. The machine is propelled by a two-cylinder petroleum engine, capable of working up to six horse-power.

THE JACKSON DOCTOR'S CARRIAGE.

What is termed a doctor's carriage has just been put on the English market by the Yorkshire Motor Car Co., Ltd., of Bradford. The vehicle, which has accommodation for three persons and is of a very elegant design, sells at \$700. The frame is built up of steel angles and is so arranged that any type of body can be suspended on it through the medium of plate springs. The motor, which is actuated by gasoline, is of the two-cylinder De Dion type, working up to about $3\frac{1}{2}$ H.P. It is located in the front of the car and is entirely covered in by a perforated metal "bonnet," the perforations allowing free ingress of cool air to the radial ribs of the cylinders.



JACKSON DOCTOR'S CARRIAGE.

Power is transmitted from the motor shaft by belts to a differential intermediate shaft and from the latter to the rear wheels by means of the ordinary sprocket wheels and chains. Three mechanical speeds are provided, there being three belts running on different sized pulleys between the motor and intermediate shafts. These belts normally run slack and are tightened by means of jockey pulleys. The handles controlling these jockeys are arranged at the right hand of the driver, so that anyone of the three speeds can be instantly applied. The ignition is electric and advancing or retarding the sparking gear any intermediate speed may be obtained. The steering is effected by means of a hand wheel, provision being also made for the starting of the motor without dismounting from the seat. The wheels are of the suspension type, with tangent spokes and three-inch pneumatics. Band brakes working on each of the rear hubs, as also shoe brakes on the tires are provided, so that the carriage which weighs complete only 500 pounds, can be quickly brought to a standstill.

MOTOR ROAD TRAINS INTRODUCED IN ITALY.

A start has now been made in Italy to provide communication between small towns and villages not linked together by railways by means of horseless vehicles, for a Scotte steam road train service has just been inaugurated between Ventimiglia, near Nice, and Vevola, the present termination of the railway system connecting the district with the province of Piedmont. The road train, which is of a type largely employed in France, where it is manufactured, comprises a twenty-seven foot combined tractor and omnibus, conveying sixteen passengers and a trailing omnibus with accommodation for twenty-four persons. Before the service was inaugurated, a trial trip was run for the satisfaction of the local authorities of the towns and villages passed through, these officials forming for the nonce the passengers. On the outward journey from Ventimiglia the grade is for the most part uphill. The distance of twenty-six miles, between that town and San Dalmezzo, occupied six hours. On the return journey, the average speed of nine miles an hour, the maximum permitted by the authorities, was easily maintained.

THE MOTOR MOVEMENT IN SPAIN.

So far comparatively little progress has been made in Spain in the use of motor vehicles, but signs are not wanting that interest in the new movement is being awakened. In Madrid the Automobile Society, formed some years ago, is slowly but surely making progress, while at Barcelona motor vehicles are now so much in evidence that the local authorities have found it necessary to appoint a committee to draw up regulations relating to motor traffic. It is also announced that Benz & Co., of Mannheim, are about to open a depot in Barcelona for the sale of its well-known motor vehicles.

Austria has for some time past had its automobile club on the lines of the well-known French club and has in this respect been in advance of its neighbor—Hungary. However, this deficiency exists no longer, as at a meeting of automobilists just held in Budapest, it was decided to form a Hungarian automobile club, a committee being appointed to draw up the necessary rules and regulations.

The West German Automobile Club, which was formed about a couple of months ago at Aix-la-Chapelle, apparently believes in the efficacy of races as a means of popularizing the horseless vehicle movement. It has already engineered a motor car race between Aix-la-Chapelle and Coblenz, while now arrangements are in hand for another race, between Amsterdam and Aix-la-Chapelle, to take place on Sunday the 24th of June. The distance is about 150 miles, and one of the conditions of the race, which is open for both motor carriages and motor cycles, is that no competitor shall be eligible for a prize whose time for the journey exceeds fourteen hours.

In connection with Mr. Winton's journey from Cleveland to New York, it may be of interest to mention that in connection with the International Cycling Congress just held in London, Dr. Von Stern, of Vienna, the Austrian delegate, "motored" the whole of the way from the Austrian capital to London, with, of course, the exception of the journey across the English channel. The distance between the two cities is between 700 and 800 miles.

Interest in the motor vehicle movement in Germany is slowly but surely increasing, and motor car clubs are springing up in all the large towns. The latest addition to the list is the Wurtemberg Motor Car Club, which has just been organized at Stuttgart, with Herr Pfautach, of that town, as first president.

The House Liquid Fuel System.

The accompanying cut represents Henry A. House's "A. L. F. U." motor wagon drawing a large omnibus carrying twenty passengers, the motor wagon itself carrying ten and a driver. The wagon is propelled by a 15 H. P. automatic liquid fuel steam motor system designed and patented by Mr. House, M. I. M. E., formerly with the Liquid Fuel Engineering Co., Cowes, Isle of Wight, England, but now of Bridgeport, Conn. There are 10 patents on the system at present and more to be added. The principal feature is the method of generating

steam from kerosene by means of a new method of gasifying the oil so that perfect combustion is obtained from a one-horse power fire to a 100 H. P. fire, and so arranged that should the fire be extinguished from any cause after it has been burning a short time it will re-ignite, thus making the machine perfectly safe to leave unattended. This oil-burning system, Mr. House says, has been working in launches and stationary plants for the past four years and has proved to be perfectly practical.

The fire is automatically regulated by the steam pressure; there is no blowing off of the safety valve or variation of steam pressure up to the limit of boiler capacity.



ILLUSTRATION OF THE HOUSE LIQUID FUEL SYSTEM OF STEAM GENERATION.



LATEST TYPE OF THORNYCROFT STEAM WAGON.

The boiler is one of Mr. House's patent non-corrosive water tube type with detachable tubes, water bottom, and hot air draft. It has 208 half-inch upper tubes, giving 65 square feet of heating surface, and a galvanized iron case, magnesium lined, measures 18 x 26 x 26 in. outside, weighs 600 pounds and will give out 15 H. P. constant.

The engines, which are tandem compound, with hollow piston valves, cylinders $1\frac{1}{2} \times 3\frac{1}{4} \times 3\frac{1}{4}$, working pressure of 250 lbs. and three throw cranks, run at one to 1,500 revolutions a minute. When starting, the operator can work high pressure in the compound cylinder, geared 15 to 1 on the drivers, thus giving a drawbar pull of 1,000 lbs. The feed pumps attached to the engines are wormed back 10 to 1, and the feed water supply to them is automatically regulated by the water line in the boiler.

The whole system is claimed to be so simple that anyone of ordinary intelligence can be taught to manage it in a few hours.

The wagon here shown is an ordinary baggage wagon, with the footboard removed and a case attached in front with the whole motive power arranged on a bedplate that can be slid in or out like a bureau drawer. The motor can be removed, if necessary, and a new one replaced, about as quickly as a span of horses could be attached to an ordinary wagon.

This system has been in operation in England for the past year, and is there known as the "L I F U" system.

Latest Thornycroft Steam Wagon.

The Steam Carriage & Wagon Co., Ltd., Chiswick, London W., England, furnish the accompanying illustration of their latest type of steam wagon, which is doubly interesting inasmuch as it shows the manner in which the yacht "Shamrock" was transported by Thornycroft & Co., of Church Wharf, Chiswick, to the final erecting yard.

Power is transmitted to the wheels by means of patent chainless gear.

The wagon shown is built to carry a load of three tons and to haul an additional load of two tons on a trailer at a speed of about six miles an hour, although it has sufficient power, if needed, to transport its full load at eight miles an hour.

Sufficient fuel (steam coal, or coke) is carried for a 40 mile journey, and enough water for a 20 mile run. The total cost of operation, including depreciation, interest, wages, and all other charges, figures out at 6 cents per nett ton

Automobile Club of France Offers International Racing Cup.

The New York *Herald* publishes cable news of a \$2,000 cup presented by an American member of the Automobile Club of France to the club as an international trophy to be competed for by the motor vehicle clubs of the world at an annual race, the scene of which is to be in France.

The conditions are as follows:

"(a) Cup to be in keeping of the Automobile Club de France. |

"(b) Any club in any country can issue a challenge for it in the name of one of its members.

"(c) Cup to belong for the time being to the winning club, and in case of the dissolution of the club to be passed to the leading club in the country.

"(d) First contest to take place in France. Afterward in the country of the winning club.

"(e) Name to be given to the race and distance to be decided at a future meeting."

MINOR MENTION.

F. E. Stanley, of Stanley Bros., Newton, Mass., sails for Europe this week on motor vehicle business.

Harry Headland, Freedom, Pa., is building a two-seated motor carriage.

The U. S. Treasury report for last week shows that \$15,212 worth of motor vehicles were shipped from this country to Havre, France.

Robert Nunnemacher, Herman Nunnemacher and Alfred James, prominent Milwaukee capitalists, are interested in a plan to introduce the new vehicle in that city.

The Forest Hill Cemetery officials, Kansas City, Mo., will introduce several gasoline conveyances to run between the terminus of the cable and the cemetery.

L. Lion & Sons, who own 5,000 acres of land at San Martin near San Jose, Cal., are contemplating the introduction of motor vehicles to connect San Martin with San Jose.

The Electric Storage Battery Co.'s officers for the ensuing year are Isaac H. Rice, president; George H. Day, vice-president, and H. Lloyd, second vice-president and manager.

William Spires, owner of the stage line between Calistoga and Lakeport, Cal., has made a contract with a San Francisco firm for a motor stage. If it is a success others will be added. The route is very mountainous.

The Safety Three-Wheel Vehicle Co., of New York City, has just been organized with \$50,000 capital by J. E. Bloomer, Freeport, L. I., and G. S. Brush and H. Schanzlin, New York City.

The National Wheel & Traction Co., of New York, is a recent organization with \$16,000 capital, to manufacture motor vehicles. The incorporators are A. Ohlsen, F. S. Dickinson and L. T. Noonan, of New York City.

The Poste Bros. Buggy Co., Columbus, O., recently incorporated with \$25,000 capital, is empowered to make and deal in motor vehicles. The incorporators are Beale E. Poste, John H. Poste, Charles D. Hinman, Henry Gumble and Frank C. Smith.

One of the largest corporations yet formed for the manufacture of motor vehicles, was granted a charter under Delaware laws last Friday. It is the United States Vehicle Co., authorized capital \$25,000,000, and it will manufacture compressed air vehicles under the Stackpole and Francisco patents.

The Ferracute Machine Co., Bridgeton, N. J., U. S. A., makers of a full line of presses, dies and other machinery and tools, are now paying special attention to the machinery that will be required for horseless carriages, and have received a number of orders for machinery and dies for making heavy ball bearings, cups and heads for boilers, and have sold presses for general work in connection with the manufacture of carriages. They claim that many parts of carriages can be made to advantage from sheet-metals, and at much lower figures than forgings or castings, stronger and more durable. They have recently issued a catalogue giving full information regarding their machinery.

OUR FOREIGN EXCHANGES.

The Naphtolette.

This simple little *voiturette* described in a recent issue of *La Locomotion Automobile*, is intended to satisfy the demand for a light, cheap carriage, suited to ordinary conditions and geared for moderate speed. The motor develops $2\frac{1}{2}$ H. P. The vehicle is so constructed that all parts are readily accessible. The body can be removed in an instant and a different one substituted. By the loosening of a few bolts the entire mechanism, motor included, may be taken from the frame. For ordinary repairs each piece can be fixed separately without disturbing any other.

The motor is of the common Otto type presenting a few novel points. The admission valve is located in an independent box. A single screw retains the valve seat in place, and makes cleaning and repair easy.



THE NAPHTOLETTE.

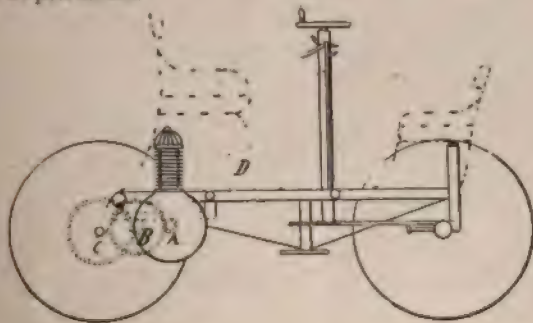
The exhaust valve, instead of being raised by a cam, as in most motors, is operated by a lever and poussoir ensuring greater regularity and more perfect closing.

A special arrangement of the fly-wheels adds a little to the power of the motor by suppressing vibration.

The cylinders are cooled without a circulation of water by the depth, form and disposition of the radial ribs, as well as by the exposed position of the motor.

The electric spark is furnished from an induction coil supplied by a primary or storage battery.

The carbureter (not shown here), is adapted to use any kind of petroleum.



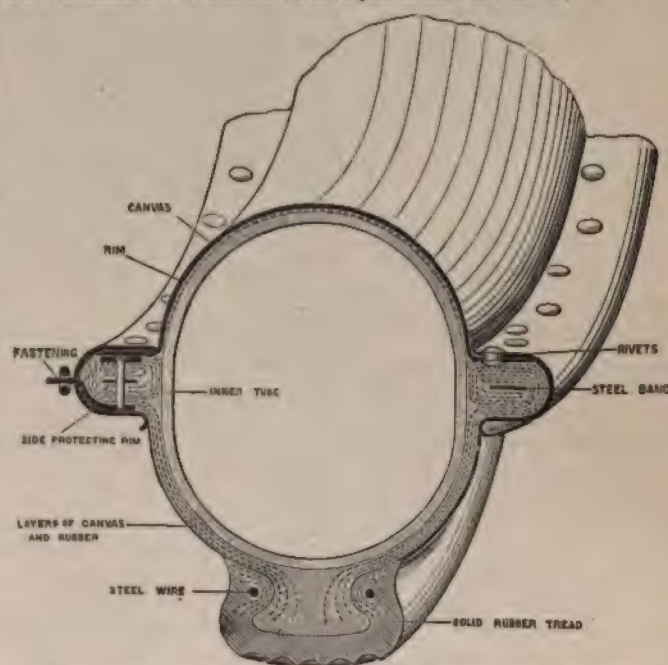
Either two or three speeds are provided, and these in turn may be variously regulated by the spark and the mixture. The speed changing gears are located in a case to protect them from dust. The motor shaft A, carries two or three gears controlled by frictions. The counter-shaft B, carries a corresponding number of pinions and a small pinion connecting with the differential C. Owing to the frictions starting, stopping and changing of speed are accomplished without shock or disagreeable noise. A single lever attached to the steering standard, controls the whole mechanism.

Two powerful brakes are used and at slow speed the motor itself may be utilized as a third brake. Heavy pneumatics give ease and comfort, which may be further increased by the addition of a top of any kind desired.

The inventors are MM. Brothier and Pougnaud, who are organizing a company to place the Naphtolettes on the market at \$500 apiece.

Simms' Patent Compound Pneumatic Tire.

Frederick R. Simms, an English engineer of Norfolk street, Strand, London, W. C., has given much attention to the motor vehicle for three or four years past, and as a result several important patents of his under this class are now to be found on the records of the continental nations and of the United States. One of these patents covers an ignition device, another refers to a light vehicle called "Simms' Motor Wheel," the illustration of which in our pages a few weeks since called forth many inquiries from our readers. Another very interesting idea of Mr. Simms' is the Patent Compound Pneumatic tire, herewith illustrated, which is said to be free from nearly all the faults the common vehicle pneumatic is heir to.



It is a three-in-one-idea, being a combination of the cushion, pneumatic and the solid tire. The rim is built up of three parts so that the two side rims may be easily and cheaply replaced without interfering with the spokes, and the entire cost of manufacture is said to be less than that of a one-piece

rim. As there is a saving in the weight of the wheel itself the rim may be of lighter section. The tire is also said to be cooled and its life prolonged by the large surface which the rim presents to the atmosphere. This extent of surface is also claimed to render a smaller quantity of rubber sufficient for the tire cover, thus further reducing weight and cost. The construction of the side flanges of the rim affords efficient protection against collision and abrasion against objects such as curbstones, which wear the ordinary pneumatic.

The tread is so formed that when worn out it can be easily removed and replaced although so securely fastened it cannot come off unless cut. Side slip is said to be almost impossible owing to its peculiar form.

Liability to puncture is said to be small because of the acute angle of the outer tread and pneumatic cover presented to projecting surfaces or obstacles on the road. But if a puncture does occur the tire immediately collapses inside the rim and the wear is then partly on the side rims and partly on the tread, which are the cheapest parts to replace.

Further claims are made on the method of fastening the cover to the rim to prevent creeping and on the lower pressure under which the tire can be used, thereby lessening strains.

The rim provides surfaces for a very efficient rim brake.

Investigating Before Legislating.

Last week a number of members of the Philadelphia Council who constitute the Committee on Law were given a ride in electric carriages to Germantown and return in order that they might have an opportunity to study the operation of the vehicles before legislating upon them, as they now have under consideration a bill to require all motor vehicles to pay a license fee of \$10 a year.

The committee first visited the station of the Pennsylvania Electric Company, on Broad street, and were shown how readily the vehicles are controlled by skilled operators. After this exhibition, the Councilmen and some of the officials of the company, made the run to the Manheim club house, Germantown and return without other mishap than the puncturing of one of the tires, which fortunately occurred before the party had gone very far, allowing another carriage to be summoned from the station.

It was stated in behalf of the company that it is not seeking legislation, but that, as the Mayor had introduced the subject, the officials thought that all that was required was some reasonable regulation as to vehicles used for hire, as the running of all vehicles is already regulated by laws forbidding immoderate speed. The idea of a license for all automobiles did not meet with much favor, and one of the legal members of the party thought such a charge would not stand the legal test, as, wherever the question had been raised as regards license taxes on bicycles the courts had decided that municipalities have no power to levy them. The opinion was expressed that the Legislature would take occasion to levy a personal property tax on such electric vehicles as are used for hire, which is the form of tax imposed on carriages used for like purposes.

It was wisely decided that the Chairman should consult the City Solicitor before preparing a bill for submission to Councils.

Chicago Judge Does Not Support Park Commissioners.

The motor vehicle gained a victory in Chicago last week Tuesday.

In the case of G. F. Marchant, representing the Fischer Equipment Co., the judge held that the prisoner, when he rode peacefully along Michigan boulevard, had not created, aided, countenanced or assisted any riot, disturbance or other disorderly conduct, as charged by the policeman who arrested him, and that the electric vehicles may be propelled along Chicago streets forever unless new laws are passed on the subject.

Whether the South Park Commissioners have authority under the law to prohibit motor carriages from running on the boulevards under their control the subject of judicial inquiry in connection with the hearing of the writ of habeas corpus petitioned for on Wednesday in the case of H. G. Osborn, engineer of the American Electric Vehicle Co., who was arrested while operating an electric carriage on Jackson boulevard.

The petition sets up that Osborn was wrongfully deprived of his liberty for an alleged breach of the peace in violation of the South Park boulevard ordinances. As ground for the issue of the order of release it declares that the running of a motor carriage on the boulevard is not a breach of the peace nor a disorderly act, and declares that the purported act of the Commissioners prohibiting the running of horseless carriages upon the boulevards is an unwarranted exercise of the police powers of the Commissioners.

No Law to Cover Motor Vehicles.

Lamson Bros., dry goods dealers of Toledo, O., have introduced an electric delivery wagon in their business, and the city authorities are unable to find in the municipal regulations any provision under which it can be taxed. A wheel tax is levied on one and two horse carriages and wagons, and on mules and bicycles, but nothing is said about electric vehicles. Consequently the vehicle goes untaxed for the present.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

LESSONS of the ROAD

Users of motor vehicles are invited to contribute to this department for the good of the industry.

Uncle Sam and His Horse.

WESTFIELD, MASS., June 24.

Editor HORSELESS AGE:

Last fall while returning from a trip to a nearby town by motor carriage I passed through one of our widest streets and saw a horse hitched in front of a house, facing the direction in which I was coming. As I drew near I noticed that he raised his head as high as his tie rein would allow, and picked up his ears very sharp. This was a signal for me to stop, and as I drew closer I saw he was a type of the well-known country horse, and was hitched to an old dilapidated wagon. I drew forward very slowly, but soon saw that he would not stand while I passed him. A boy whom I had with me went into the house in front of which the horse was hitched, but the owner was not to be found inside. He was in the house on the opposite side of the street. The boy crossed over and called for the man who owned the horse. The owner soon appeared, and proved to be a veritable "Uncle Sam," wearing a long linen duster. He came out to the curbing in front of the house and motioned me to go on. I called to him to go across the road and hold his horse, as I knew his horse would not stand, but he still made motions for me to go on. The boy then returned to me and said that the farmer said his horse had met my carriage several times before, and had passed it without being afraid. With this assurance I took the side of the road most remote from the horse, and crept forward very slowly. The horse kept his eyes fixed upon the carriage as I slowly passed him. Finally I had passed so far that his tie rein would not permit him to turn his head any farther, when he faced forward, lowered his head and raised his heels and wriggled them in a very vigorous manner. The farmer ran across the street, took hold of his bridle and began to slap him on the head. I went back to assist him, but the faster the slaps were applied the faster the heels flew. I then held his bridle while "Uncle Sam" applied a few vigorous kicks, but all to no purpose. His horsemanship had seen the carriage go without a horse, and had decided that the one he was hitched to should travel that way hereafter, for no amount of suasion, either moral or otherwise, would cause him to stop. Upon freeing himself from the carriage, he turned around, so that he might face my vehicle, which had been left some distance down the street. He did not attempt to run away; it was simply a case of "must see it." I assisted the farmer to gather up the remains, and then asked him if he considered it my fault, to which he replied, "No," and immediately proceeded to libel his horse in vigorous language.

A few days later he appeared at my store and said that he had talked the matter over with a neighbor, who advised him to see a lawyer, who informed him, that I had no right on the public highway, and was liable for damages, which he assessed at \$6, proved by a bill from a repairer. I explained the circumstances to him over again, and he went away, to all appearances satisfied, but in fact, went straight to a clothing

house, for whom I was advertising at the time, one of whose customers he was, and rather than lose his trade, they offered to give him a new pair of Sunday pantaloons. He was evidently not satisfied, and went away without accepting the terms of peace. He appeared again a few days later and was finally fitted out with a \$7 suit of clothes, and went his way rejoicing, being a living advertisement for the clothing house.

Moral: Horses have no brains, and horse beaters less.

Yours truly,

GILBERT J. LOOMIS.

"Brainless Drivers and Ownerless Horses."

BROOKLYN, June 22nd.

Editor HORSELESS AGE:

I think owners of horseless carriages need protection from "brainless" drivers and "ownerless" horses. I made a short run yesterday to New Jersey with my gasoline carriage, going by the Annex boat. As I was going up Mercer street, in Jersey City, a horse attached to a carpenter's wagon, took fright, but was stopped after running about half a block. Whoever had charge of this wagon was out of sight.

Returning, we met a horse attached to a wagon of some soap manufacturer leisurely traveling down Mercer street all by himself there being no one in the wagon to guide the animal. Two blocks above the City Hall he started on a run. A police officer who was on hand and could easily have checked his progress made no effort to do so. After running two blocks the horse fell in front of the City Hall. I sincerely hope that the animal was not injured and that owners of horses will learn that it is not safe to leave them on the street unattended.

Respectfully,

J. B. HOECKER.

The New Duryea Trap.

The National Motor Carriage Co., 1 Madison avenue, New York, successors to the Duryea Motor Wagon Co., have completed the first of their new model traps, and have forty more nearly finished.

The mechanism of this vehicle is the same as that of the touring cart recently described in these columns. The price is \$1,000, with detachable canopy top, \$1,050.

Appeal in the West Case.

J. B. West, the Rochester, N. Y., inventor who was sued by Mason Bros., laundrymen of that city, for \$49 damages for alleged negligence in driving a steam motor carriage through the street and frightening the plaintiff's horse, and who lost his case in the municipal court, has appealed it to the Monroe County court, and the trial will probably take place at the September term of that court in Rochester.

Stephen M. Balzer, 370 Gerard avenue, New York City, has received an order for ten of his carriages from the American Automobile & Motor Co., Ltd., Paris, France. The carriages will be speeded up to thirty miles an hour.

Joseph J. Mandery, Rochester, N. Y., formerly a bicycle dealer, has started in the motor vehicle business under the title, the Rochester Automobile Co., having secured the local agency for the American Electric Vehicle Co., Chicago, Ill., and the National Motor Carriage Co., of New York.

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

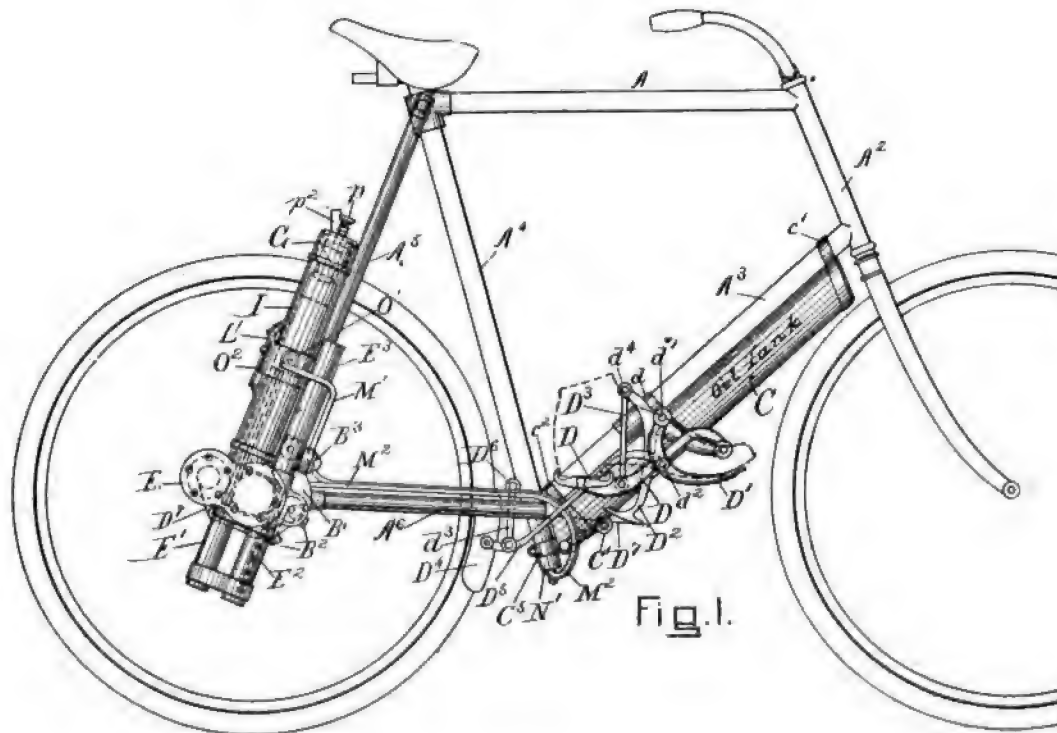
No. 627,359.—Automobile Vehicle.—Herbert B. Steele, Malden, Mass. Application filed January 18, 1897.

The frame of the vehicle shown follows closely the usual construction of the frame of the well known safety-bicycle. It varies therefrom at the seat-post joint, at the joints of the axle of the rear wheel, and at the lower central joint. Below the lower forward diagonal brace A3 and attached thereto is the oil-reservoir C and the foot-levers D D1 for controlling the speed and power of the vehicle and which are also attached to the brace. Upon the joint B at the rear of the frame, on the side shown in Fig. 1, is carried an explosion engine burning oil from the reservoir C, which it takes by means of the tubes M1 M2, connecting the engine with a spraying device carried in the lower end of the central member A4 of the vehicle-frame and with which spraying device the oil-reservoir communicates. The brake-shoe D4 (Fig. 1) is connected with the toe lever D1 by the long ogee-curved link D5. The said toe-lever is pivoted to the bracket d at d1 and is connected with the ogee-link at d2, and the rear end of the link is attached by a short link d3 to the upright member A4 of the frame. The depression of the toe-lever D1 by

the toe of the rider will move the brake-shoe against the tire of the rear or driving wheel.

The heel-lever D is pivoted at its forward end to the lower end of the bracket d and is operated to draw or release the cord D7 by means of the link D3, attached at its lower end to the lever D and at its upper end d4 to a lever D2, which is pivoted at d1 to the bracket d and the lower end of which is attached to or connected with the wire cord D7, extending to the engine. Through this cord the movements of the heel-lever are communicated to that part of the mechanism of the engine by which the amount of power delivered to the driving-wheel is regulated.

The hole provided by the tube A5, forming the descending rear strut of the frame, forms a passage by which air is fed to the engine. This tube should be made rather larger than is usual with the corresponding tubes—say of seven-eighths of an inch internal diameter—to provide a large air-passage and the air enters the passage through the seat-joint from its under side and is there strained from dust by means of a tuft of raw cotton or other strainer contained therein. The air enters through the orifices a, a cavity b in the joint-piece B, to which piece the tube A5 and the tube A6 are firmly united. The air then passes through the opening controlled by the check-valve B1 and through the passages b2 b3 in the joint-piece B and finally through the orifice b4 into the interior of the lower casing E of the engine. The check-valve opens to admit the feeding of the air to the casing-chamber and closes to prevent its being forced backward through the same. It may have a spring to bear against it, hold it in place, and accelerate its action, if desired, and the valve is accessible by means of the removable cap B3. The piston of the engine acts as an air-pump in connection with the chamber of the lower casing and the said air inlets and outlets, hereinafter referred to, causing the air to be drawn in through the inlet above described and to be forced outward to the spraying-chamber to combine with the oil therein and also to the piston-chamber to there combine with the vapor fed to it. The lower casing E



corresponds in a way to the bed-casting in the ordinary type of stationary engines or the crank-case in others. To it by means of a raised flange E4 is rigidly secured the cylinder F of the engine, the lower end F2 of the cylinder having a screw-thread by which it is screwed upon the threaded section of the said raised flange. There is also secured to the said casing E the bearings of the engine-shaft Q and the bearings of the regulating-shaft Q1. The casing has the part B5 turned concentric with the engine-shaft, and it is secured by screws B2 to a seat in the joint-piece B, which is bored concentric with the axle of the driving-wheel, the fastening-screws extending through the joint-piece and screwing into the case. This construction maintains the engine-shaft in line with the axle and at the same time permits the easy removal of the entire engine from the vehicle-frame.

The cylinder of the engine preferably lies along the rear diagonal of the frame. (See Fig. 1.) The piston is represented as built up from the pieces of tubing J, J1, J2. This construction, however, is immaterial, and additional weights may be added in the cavities in proportioning the weight of the piston to its number of reciprocations per minute. Extending downward from the central portion J1 of the piston and to which it is attached is a rack J3, which engages or meshes with a gear, concentric with the engine-shaft and borne upon it by ball-bearings, so that the gear is free to turn on the shaft and the shaft within the gear. The power of the engine from the explosion of the charge above the piston is delivered by the piston through the said rack to the said gear and is transmitted to the engine-shaft by mechanism hereinafter described.

Below the piston, within the cylinder F and generally concentric therewith, is a powerful spring F and generally con- which is to receive and store up sufficient of the power of the explosion on the downstroke of the piston to return or move upward the piston to its highest position and to compress the gaseous charge above the same. The lower end of this spring bears upon a plate K1, which is held between the bottom end of the cylinder and the seat thereof in the central case and which plate has an upward tubular extension about which the lower end of the spring extends and which acts, together with the back of the rack, as a guide for the spring and to maintain it centrally in the cylinder. The spring at its upper end is held and guided centrally by the lower end of the tubular piston, within which the upper end of the spring extends and also within which the spring largely retracts during the downstroke of the engine. The upper end of the piston-chamber has a large opening, which is closed by the induction-valve G2, normally held lightly to its seat by the spring g2, bearing on the enlarged upper end of the guiding-stem. This valve closes upward, and a space H of the cylinder of sufficient size to receive a proper charge of the compressed explosive mixture is provided between the under surface of this valve when closed and the upper surface of the piston when in its highest position. The air, which forms a part of the explosive charge, is fed through the passage controlled by this valve to the piston-chamber, the charge of air acting to lift and hold the valve from its seat during its passage and the valve being immediately returned to its seat by its actuating-spring and to be firmly held to its seat by the compression of the charge and its subsequent explosion. The valve is held centrally with its seat by its stem which is fitted to a hollow boss or sleeve g, made integral with the pieces G3, providing the valve-seat, being connected therewith by the arms g5. (This letter is also used to indicate the space between the side arms.) The outside of this sleeve is accurately fitted to and

forms the guiding-surface for a second or auxiliary valve G4, which auxiliary valve acts to close the passages I1, extending through the valve-seat piece from the exterior of the cylinder F, these passages forming the connection between the cavity or chamber I2 between the cylinder and the case I and which contain compressed air and through which the compressed air is delivered from the compressing-chamber. The auxiliary valve has a slight opening movement which may be unopposed. A further opening movement brings it into contact with the lower end of the valve-spring g2, above referred to, the connection being established by means of a washer surrounding the valve-stem g3 and upon which the said spring g2 directly bears and against which washer the upper end of the tubular extension of the valve G4 strikes on continuation of opening movement.

The auxiliary valve may or may not be operated with every incoming charge of air. Its special and peculiar function is to close the passages I2 upon the occurrence of a heavy pressure in the chamber G1. This chamber is formed in a piece or case G extending from the cylinder F and to the threaded section F2 of which it is firmly attached. The valve-seat piece G3 is held in place between the casing G and the cylinder by means of the end of the cylinder-case, upon which a shouldered portion of the valve-seat piece rests and a shoulder formed upon the side of the case G, which bears upon the upper edge of said shouldered section, the shouldered section of the valve-piece being of the bore of the portion of the case G between its said shoulder and the upper end of the cylinder. One purpose of this last-named construction of chamber and valve is to provide a chamber in which a primary or starting charge is formed and fired and which is of a sufficient capacity to hold enough explosive mixture to produce an explosive effect which shall approximate that of the regularly formed and compressed charge normally fired in the explosive-space H of the cylinder when the engine is running. Upon such primary explosion in the chamber G1 the auxiliary valve G4 closes the passages I1 and the valve G2 opens, whereby the whole charge passes by the valve into the explosion-space H above the piston, igniting any mixture that may be there and expending itself in driving the piston.

A casing I, made of thin metal, entirely incloses the cylinder and forms the air-space I2, which is used as a passage for the air forced from the lower case, as above mentioned. That the casing I may serve this purpose it is formed with reinforcing-bands i at its upper end, where it fits tightly over the body of the extension-chamber G1, and also with the band i2 at its lower end, where it fits over the flange E4 of the case E. There are opening I1 through the extreme lower end of the cylinder by which the air enters the space I2 from the compressing-chamber, and other holes are formed through the exhaust-port ring, for permitting the flow of air from the compressing-chamber to the said chamber G1. There is formed in the walls of the cylinder at a point which is uncovered by the piston near the end of its motive stroke a number of holes F4, forming exhaust-ports for the burned gases. At this point the cylinder is reinforced by a ring through which the ports are continued to the atmosphere. This ring interrupts the continuity of the passage I2 aforesaid, but the parts of the casing are shouldered into the ring and provided with reinforcing-bands below and above, and the passage is continued by vertical holes through the ring between the exhaust-ports.

Oil in the form of spray mingled with more or less of its vapor and air, upon which it is borne, enter the cylinder at the port L, located sufficiently above the exhaust-ports to provide

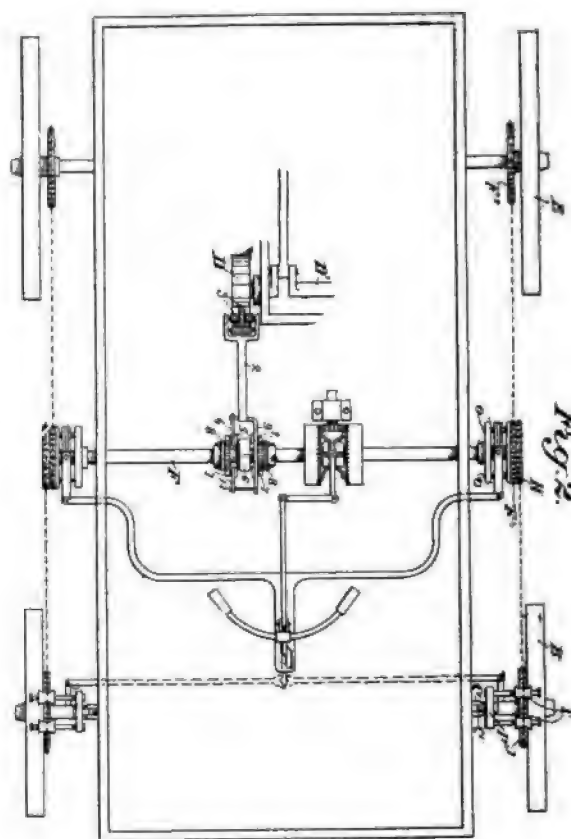
time for the oil spray, etc., to enter the cylinder after the piston on its upstroke has passed and closed the exhaust-ports, thereby preventing oil from being drawn out unconsumed from them. The vapor entering the cylinder by said port is controlled by a governing mechanism which proportions the amount supplied to the requirements of the engine. A valve L6, suitably operated, prevents the forcing back of the flame into the vapor-supply passage when the piston uncovers its admission-port on the motor stroke, and the construction and operation of this part of the invention will be described later.

The cycle of movement or progressive use of the working fluid in this engine is similar to that of the so-called "Robson" engine, described on page 196 of the *Gas Engine* by Dugald Clerk, London, Longmans, Green & Co., 1894. In this Robson method "gas and air are drawn into the front end of the cylinder during the return stroke of the piston through an automatic valve and at atmospheric pressure. The next out or motive stroke of the piston compresses the mixture in an intermediate chamber, and when the piston is fully out and the exhaust-ports of the cylinder fully open these compressed gases lift a valve leading to the compression-space of the engine, discharging before it the burned gases contained in the cylinder through the exhaust-valve and filling the cylinder and space with the explosive mixture. This reduces the pressure in the intermediate chamber, so that the return stroke of the piston besides compressing the explosive charge in the explosive-space of the cylinder can draw a fresh charge into the intermediate chamber, there to be compressed and used as before."

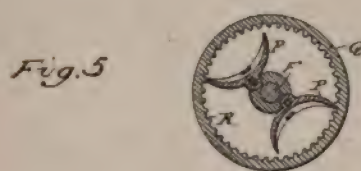
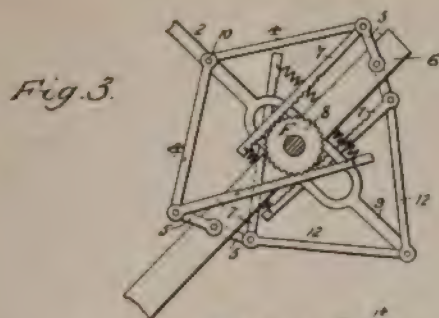
In the present method the means of accomplishing the various steps differ from the Robson, as do also the mechanical devices for accomplishing it, and by this method the air and the fuel are kept separate and the oil is restrained from entering the cylinder until after the air is admitted and has forced from the cylinder the burned gases and also until after the exhaust-ports are closed. This insures that there shall be no loss of fuel. The explosive charge is ignited automatically by the heat of the compression, which is made high enough—say one hundred pounds to the square inch—to do so, being sufficient when taken in connection with the heat remaining from the previous explosion, and care should be taken to use a spring that shall be strong enough to store up sufficient power to permit it to effect this degree of compression upon the mixture. The reciprocating parts of the engine should be sufficiently heavy to deliver this stored force at the end of the return stroke of the piston while the compression in the explosion-chamber is going on.

No. 627,282.—Motor-Carriage Driving Mechanism—Walter E. Twitchell, of St. Helena, Cal. Application filed November 4, 1898.

In a former application for which patent was issued September 6, 1898, No. 610,503, the inventor has shown a mechanism for transmitting power from the motor, consisting of a crank-shaft having a sprocket-wheel thereon, a chain connecting said sprocket-wheel with the counter-shaft, from which by other chains and sprocket-wheels and intermediate shafts power is transmitted to the vehicle-wheels. In the present case the mechanism necessary has been reduced first by the employment of the guide-rollers 11 and a single endless chain to the front wheels in place of an intermediate shaft and two chains from the counter-shaft, and by mechanism which consists of a disk having the curved channels or guides D, which are fixed upon and rotated by the shaft D1 of the



motor. The connecting-rod or pitman 2 has rollers 3 journaled upon it at such points that they will clasp the star-shaped yoke D, or, if the latter be a similarly-shaped channel in the face of a disk a single roller will be adapted to travel in that channel, the result in either case being that there will be four reciprocations of the rod 2 for each complete revolution of the shaft D1, and these may be increased or diminished by making a less or greater number of the convolutions D with which the guiding roller or rollers engage. At the opposite end of the pitman 2 are hinged or pivoted rods 4, which diverge and have their outer ends connected with one end of links 5, and the other end of these links is pivoted to an arm 6, which extends radially in each direction from a loose hub or sleeve on the counter-shaft F. From the junction of the arms 4 with the links 5 the rack-bars 7 extend inwardly and have the toothed gears 8 upon the counter-shaft. The rack-bars are retained in contact with these gears by springs pressing the bars, and the rods 4 and links 5 are caused to move in unison by means of a guide 9, which extends from the joint connection 10 across the shaft F and is jointed at 11 to arms 12, which extend outwardly and connect with the links 5, as shown. The rod 9 is separated to form a yoke where it passes the shaft F and is slidable through openings made in the hub or sleeve of the support 6, so that this rod 9 may reciprocate in unison with the movements of the pitman 2, and the diverging rods 4 and 12 will partake of this movement. By this operation the rack-bars 7 are alternately caused to reciprocate transversely over the gears H, and by means of pawl-and-ratchet or other clutch mechanisms these gears are caused to turn the shaft F when moving in one direction and are allowed to return freely when the racks move in the opposite direction. By the peculiar arrangement of this trans-



mitting mechanism one pair of the racks will always be acting to impel the gears with which they are connected and turn the shaft F in a forward direction, while the others will be retracted, and the pawl-and-ratchet or clutch mechanism will allow them to turn backward freely without affecting the movement of the shaft. In this manner a continuous power is applied to rotate the shaft F at each reciprocation of the pitman 2, and there may be as many of these reciprocations as there are numbers of convolutions of the guide D.

In Fig. 4 is shown a modification of this mechanism in which a ratchet-wheel 13 is surrounded by a cylindrical sleeve 14, having a diagonal slot 15 made across its face. The reciprocating arms in this case have travelers I fixed to them which are slidable in these slots, and as they slide in line parallel with the shaft the diagonal position of the slots causes the sleeve to be advanced at each reciprocation, and rapid reciprocations will produce a continuous revolution of the shaft in the same manner as previously described. This device will give a less speedy movement and a greater power, but is essentially equivalent in its operation with the device previously described.

In the reversing-gear in the former application a pinion was shown fixed upon the central shaft and rocking pawls P upon opposite sides with spirally-twisted bars o, which were slidable in correspondingly-shaped slots, so that when moved in one direction the pawls would be turned so that the teeth upon one side would engage with the pinion, causing the rotation of the shaft to turn the exterior sleeve in one direction, and when the opposite side of the rocking pawls were engaged the shaft would be turned in the opposite direction. In the present invention these clutches have been reversed, making an interior gear R in the outer casing Q, and the rocking clutches P are reversed, so that the pivot points are central upon the sleeve surrounding the shaft and the ends of the

arched locking-clutches are adapted to engage with the internal gear-teeth R, this construction giving a stronger and more effective mechanism than that previously described.

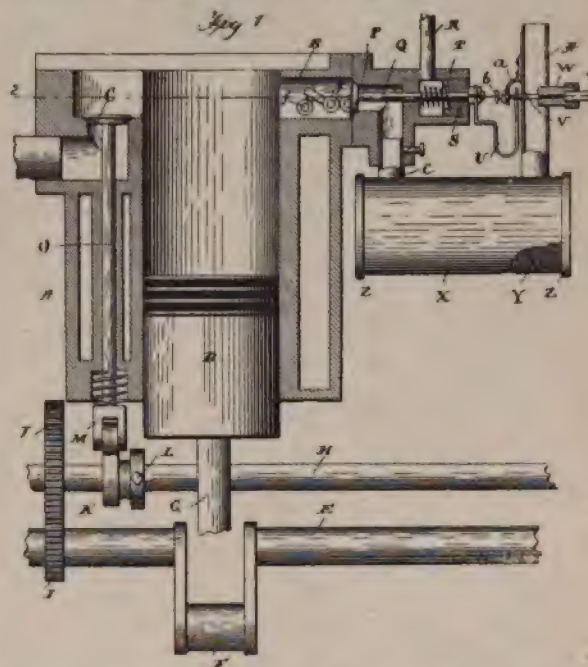
No. 627,372.—Fluid Feeder or Regulator for Explosive-Engines.—Alexander Winton, Cleveland, O. Original application filed September 18, 1897. Divided and this application filed May 4, 1898.

In the accompanying drawings, Fig. 1 is a longitudinal sectional view of an engine with this invention applied. Fig. 2 is a horizontal sectional view taken on line 2, 2, of Fig. 1. Fig. 3 is an enlarged sectional view taken on dotted line 3 3 of Fig. 2.

A represents a cylinder having the usual water-jacket, and B the inlet to the explosive end thereof, through which the explosive mixture is drawn.

E is the driving-shaft, F the crank-pin, and G the piston-rod connected in the usual manner with the crank-pin through the medium of a pitman.

C is the exhaust-valve, and D the piston.



Extending preferably transverse the cylinder and parallel with the driving-shaft is the counter-shaft H, carrying a cam K, engaging a wheel M in the lower end of the exhaust-valve stem O, the shaft H being driven through the medium of the gears I and J, whereby the shaft H has one revolution to every two of the shaft E, as is usual in explosive-engines. The cam K is so situated and is adjustable upon the shaft H, through the medium of the clamping-screw L, that the exhaust-valve is lifted at the proper time to permit the escape of the exhaust, as is well understood by those skilled in the art.

Situated within the suction inlet B are the electric contacts.

Communicating with the air-pipe A1 is a gasoline supply pipe W, having a needle-valve V coating therewith. This needle valve, as shown, passes through the opposite side of the pipe A1 and through the means of a U-shaped spring U is connected with either the valve-stem, as here shown, or the piston S, as may be preferred. Situated just outside of the outer end of the needle-valve V is a bracket a, carrying an adjustable screw or member b, adapted to engage the end of the

Fig. 2.

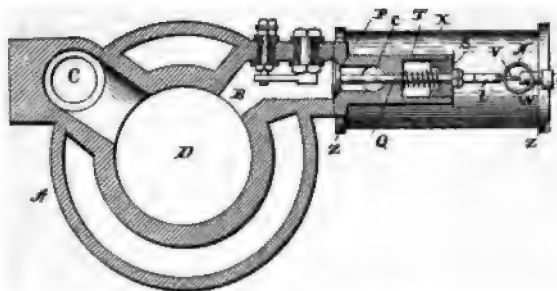
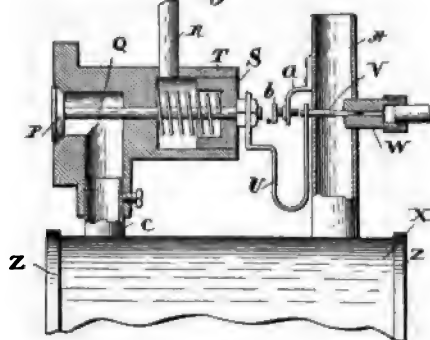


Fig. 3.



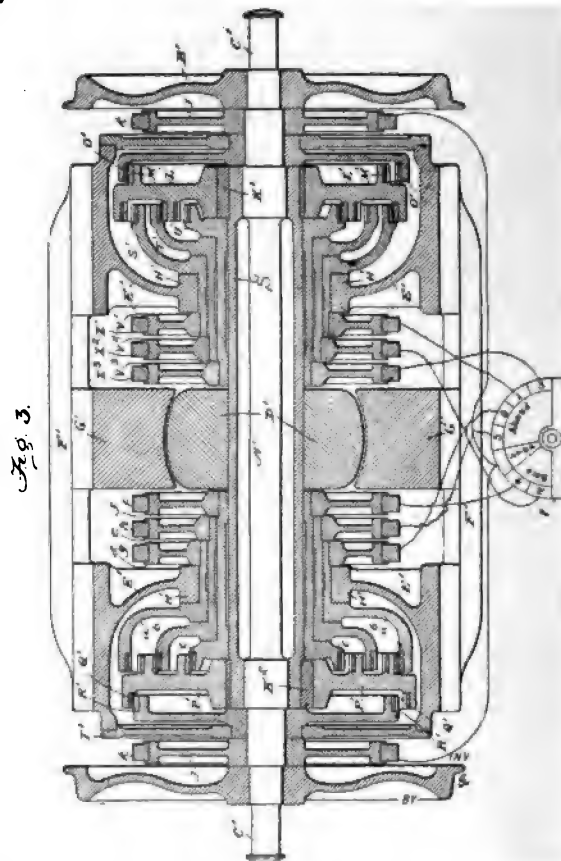
valve V as it is being reciprocated and to thereby regulate the distance the valve shall be drawn from its seat, which in turn regulates the amount of gasolene supplied at each movement of the valve.

A box or chamber X has detachable screw-threaded ends Z, and this box or chamber is filled with wire-cloth Y. One end of this box is provided with an air-pipe A1 for the inward passage of air, as indicated by arrow, and at the opposite end with a pipe c, communicating with the explosive end Z of the engine-cylinder. This inlet c is intersected by the valve P, having a valve-stem Q passing through the wall of the inlet and outward through a cylinder T. This cylinder T is provided with a piston or diaphragm S, and a pipe R communicates with the cylinder at a point inside of the piston. This pipe R is connected with a pressure-producing device, preferably an air-pump, and the pressure upon the piston is varied, according to the speed of the engine, as fully described in patent granted the 4th day of May, 1897. A spring serves to hold the piston S normally outward.

In operation let the piston be at the top of the stroke and having thus completed the exhaust. As the piston moves down within the cylinder air is drawn through the pipe A1 and the chamber X, which owing to its filling thoroughly breaks up the gasolene into vapor, as well as thoroughly mixing the vapor with air, and thence through the inlet-port B to the explosive end of the cylinder. When the air-pressure rises by reason of the engine running faster than its normal speed, the movement of the inlet-valve is less, allowing less combustible mixture to pass into the cylinder until the speed of the engine is decreased, and with the decrease of the speed of the engine the air-pressure upon the piston D likewise decreases, allowing the inlet-valve P to be opened wider, thus automatically controlling the speed of the motor. When the piston rises, the gases are compressed and fixed at the end of the stroke, forcing the piston down. The following stroke is the exhaust, and so the cycle of operation goes on. The

movement of the piston S is at times greater than the movement of the valve V, and hence it is necessary to have a uniform stop or regulator for the valve—that is to say, the valve P is regulated as described in previous patent referred to and its movement varies—while it is necessary and desirable to have the valve P move a uniform distance, and hence this is provided through the medium of the stop herein referred to to prevent the needle-valve being opened too far by the opening of the valve P, which would otherwise occur. The additional movement of the valve P, to which the needle-valve is connected, is permitted through the yielding of the spring U, which actuates the needle-valve. By means of this construction we have a uniform movement of the needle-valve V and yet by the simple arrangement we can regulate its amount of movement to suit the amount of air admitted through the pipe A1. The chamber X, being filled with wire-cloth Y, thoroughly breaks up the gasolene into vapor and thoroughly mixes the vapor with the air passing there through into the explosion end of the cylinder.

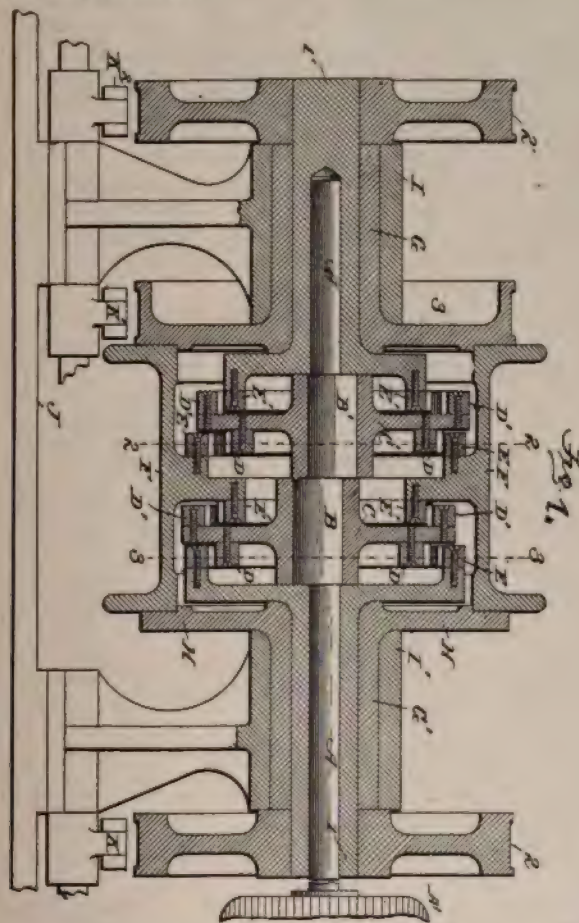
No. 627,383—Power-Transmitter—George B. Birrell, of New York, N. Y., assignor to the Birrell Universal Transmitter Company, of same place. Application filed May 15, 1897.



This invention relates to that class of power-transmitters for imparting motion, and thereby transmitting power, but at a different rotary speed, from a shaft or prime mover to another shaft or final mover in line with or concentric to the prime mover, said transmission of motion and power being accomplished without the use of a counter or jack shaft, but by means of certain combinations of gears.

No. 627,382.—Power-Transmitting Mechanism—George B. Birrell, New York, N. Y., assignor by mesne assignments, to the Birrell Universal Transmitter Company, New York. Application filed February 21, 1896.

This invention has for its objects to provide such construction, combination, and arrangement of mechanical devices as will secure reduction of speed and increase of torque in equal proportions from prime movers—such as electric motors, steam engines, etc.—permitting at the same time the reversal of the last mover of the mechanism without reversing the the prime mover, and to also establish a perfect balance or equilibrium of the mechanism without the aid of any extraneous balancing mechanism *per se*; and with these ends in view my invention consists in the employment of two sets of differential gears secured to disks running loosely on but driven by two eccentrics of equal throw, the throw of said eccentrics being diametrically opposite to each other and combining with said arrangement of devices a suitable prime mover and last mover.



Where one set of differential gears are used it is impossible to balance the same by the aid of an ordinary counterbalance, for the reason that although the action of the eccentric engages all the teeth of the gears fastened on the disk with the teeth of the gears with which they engage at each revolution of the eccentric, the advancement of the periphery of this disk is only a small proportion of its circumference, while the counterbalance, being attached to the eccentric-shaft and necessarily running synchronously with the shaft, generates centrifugal force in proportion to its velocity and its weight at its

center of gyration, and the disk naturally generates through its action a very slight amount of centrifugal force, and hence a true balance is impossible to effect, and with the further disadvantageous result of necessarily heating the eccentric-shaft bearings and a consequent loss of alinement from this cause. In other words, if under the conditions involved in the use of a single set of gears and the ordinary balance a true balance is secured by accident at a given rate of speed such balance will necessarily be destroyed upon any change of speed of the prime mover which may become necessary. It is a well-known fact that in reversing an electric motor having to regenerate at each reversal its counter electromotive force and overcome the inertia of its armature and commutator is a most wasteful condition, and the same is true also where the service of a steam engine or water-wheel is employed as a prime mover in overcoming their inertia and regenerating centrifugal force on each reversal. Not only do such constructions involving such action become wasteful of generated power, but it will be readily seen that it also involves waste in time as well, and also that it becomes difficult, if not impossible, to make delicate or sensitive movements, such as are essentially desirable in many instances, such as the raising and lowering of elevators, the rotation of ship's turrets, and the raising, lowering, and sighting of heavy guns. It being a recognized fact that in the employment of one set of gears it becomes absolutely necessary to bring the prime mover to a static condition before reversal can take place, it follows that whenever celerity of action is imperative the use of a single set of gears would be impossible.

This invention is designed to overcome all of the enumerated disadvantages incident to the use of a single set of gears and to provide means by which the power and motion of a prime mover may be economically and quickly transmitted to the object to be moved or operated upon.

BRITISH PATENTS.

No. 3,771—Improvements in Oil and Like Engines.—Charles Maximilien Koch, Paris, France. Application filed February 20, 1899.

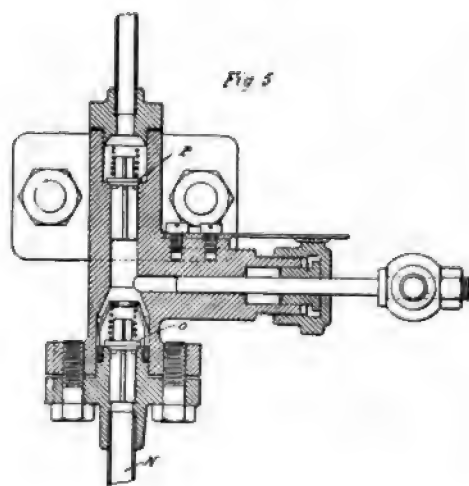
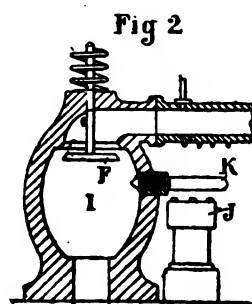
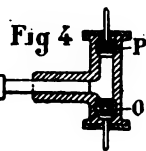
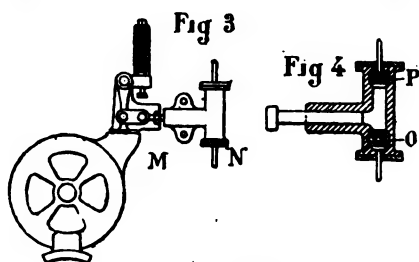
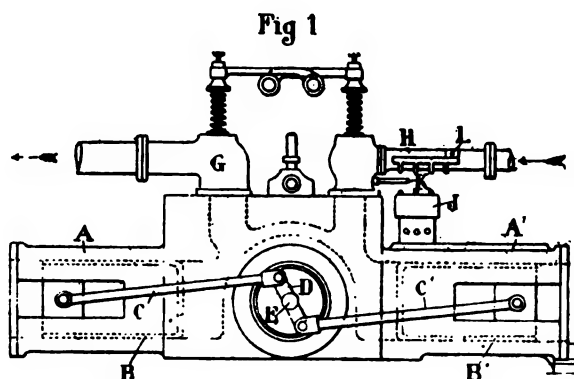
The object of this invention is improvements in petroleum motors, and it is especially applicable to a four-stroke cycle motor working with heavy petroleum of a density about .780 to .830, with petroleum spirit, alcohol or other liquid capable of producing an explosive vapor. This motor is characterized by the absence of a carbureter, the liquid being injected into a special explosion chamber; it is a balanced motor and may be either vertical or horizontal.

Fig. 1. is a general view showing a horizontal motor with two cylinders.

Fig. 2 shows the explosion chamber of peculiar shape, and Fig. 3 is a general view of the pump serving to inject the liquid, and Figs. 4 and 5 are sections to a larger scale, showing in detail the interior arrangement of the valves of the pump.

The motor is composed of two vertical or horizontal cylinders A A', between which is a wide space. Two pistons B B' move in opposite directions and symmetrically in these two cylinders. The connecting rods C C' actuate a crank D on a shaft E.

The admission and exhaust by the valves F and G respectively, are in the space between the two cylinders. There is only one admission and one exhaust for the two cylinders.



The whole system is thus balanced; as the shaft is placed between the two cylinders all strains are counteracted and in consequence no vibration is produced.

H is a tube (provided or not with ribs), by which air enters the explosion chamber I; the liquid also enters the tube H and passes into the chamber I mixed with air. J is a lamp heating the tube H and the ignition tube K. For this method of ignition may be substituted if preferred any other method of ignition.

L is a pipe by which the petroleum coming from the pump M enters the tube H; N is the point of admission of oil into the pump. This pump is operated by the motor by means of a system of levers which can be adjusted by springs. It works as a force pump owing to the arrangement of the springs O P of its valves and of its piston, which may be either vertical or horizontal, as may be the valves; if the piston is vertical the springs are horizontal, and vice-versa.

The vaporizing chamber is in one with the explosion chamber. To vaporize heavy petroleum a vaporizing chamber of very high temperature is needed; with this object it is of an ellipsoidal or spherical form, so as to have only a small surface for radiation with a large capacity. To prevent the air to be mixed with the sprayed petroleum entering the vaporizing chamber when cold, the whole of the air and the petroleum injected by the tube L is heated by the flame of the lamp J, which also heats the ignition tube.

The admission valve F is operated by the motor—it is a lift valve and has only a small movement. By this arrangement the gaseous mixture is forced to circulate along the walls of the chamber, which are thus further heated. It is obvious therefore, that all the conditions for avoiding loss of heat from the vaporizing chamber are fulfilled.

This motor operates in the ordinary manner; it may be used as a stationary engine and by its balanced system it is said to cause no vibration on motor vehicles.

No. 1,670.—Improvements in Motors Actuated by Gases Under High Pressure.—Lewis B. White, New York, N. Y. Application filed January 24, 1899.

This is the carbonic acid system of the Industrial Investment & Development Co., 1123 Broadway, which has already been described in our columns.

AUSTRALIAN PATENTS.

A Motor Operated by Compressed Air.—J. Geuer, 82 Vine street, Windsor, Victoria. 18th January, 1899. No. 15,859. In the Colony of Victoria.

Motor Car or Carriage.—A. J. Chapman, of 59 Rosslyn street, West Melbourne, Victoria. 24th January, 1899. No. 15,867. In the Colony of Victoria.

Explosion Engines.—H. V. Hampton, of 504 Elizabeth street, Melbourne, Victoria. 27th January, 1899. No. 15,882. In the Colony of Victoria.

Driving and Brake Mechanism for Cycles and Other Vehicles.—The New Departure Bell Co., of 222 North Main street, Bristol, County of Hartford, State of Connecticut, U. S. A. (Assignee of Harry Pond, of Townsend, of Bristol aforesaid). 17th February, 1899. No. 15,922. In the Colony of Victoria.

Method of and Apparatus for Loading, Unloading and Handling Storage Batteries for Motor Vehicles.—G. H. Condict, of 1684 Broadway, New York, U. S. A. 22d February, 1899. No. 15,932. In the Colony of Victoria.

Controllers for Electric Motors.—H. P. Davis, of 327 Neville street, Pittsburg, County of Allegheny, Pennsylvania, U. S. A. 7th April, 1899. No. 16,045. In the Colony of Victoria.

Controllers for Electric Motors.—H. P. Davis, of 327 Neville St., Pittsburg, in the County of Allegheny, State of Pennsylvania, U. S. A. 20th April, 1899. No. 16,084. In the Colony of Victoria.

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The Horseless Age

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Interest of the
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ESTABLISHED 1895.

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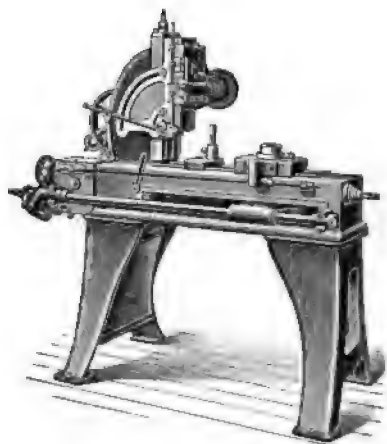
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EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. IV.

NEW YORK, JULY 5, 1899.

No. 14.

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E. P. INGERSOLL, Editor and Proprietor.

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by New York banks on small checks under their
new rule, subscribers are requested to remit by
Post Office or Express money order or N. Y. draft.**

Anti-Motor Legislation in Chicago.

The motorphobia has struck Chicago like a cyclone. No sooner does the South Park Board direct a vicious sally at the motor vehicle than the other civil authorities are stirred to action and the mayor himself takes a hand in the onslaught. He has just directed the Law Department to draft an ordinance requiring all drivers of motor vehicles using the public streets to be licensed. It is reported that applicants for licenses will be subjected to a rigid examination under the supervision of the civil authorities, the French plan being followed as closely as possible. The examination will consist of a physical test and an investigation of the applicant's mechanical knowledge and his ability to operate a motor vehicle. The reason assigned for this radical action is that several accidents have happened through the incompetence of drivers of motor vehicles.

The logic of this procedure is worth following closely. It is contended that because a number of accidents have occurred

through incompetent motor drivers all motor vehicle drivers should be licensed. How then about horse drivers? Accidents to horse vehicles are of daily occurrence. Shall we, therefore, license all horse drivers, or is it assumed that motor vehicles are more prone to accident than horse vehicles? It has been repeatedly asserted in these columns and can easily be proved that motor vehicles are more easily controlled than horses; that they can safely make higher speeds in city streets; that they do not run away and that they immediately obey the driver's will. It has also been admitted that there is among motor vehicle drivers a disposition to exceed the limit of speed which can safely be taken in crowded thoroughfares. The proper method of regulating this, however, is by an ordinance limiting the speed of motor vehicles within city confines, and not by compelling motor vehicle operators to take out licenses when in strict justice horse drivers are in greater need of restraint.

The law that the mayor of Chicago contemplates enacting is too unfair to long burden the statutes if it should be passed. It is an abuse of the law-making power, born of ignorance of the subject with which it deals, laying onerous burdens and unnecessary restrictions on one class of users of the highways and allowing another class to go scot free. It will not stand the scrutiny of the courts.

The Automobile Club as an Intellectual Influence.

The New York Automobile Club, recently founded, is welcome for many reasons. It will be a strong deterrent to Park Boards and other short-sighted authorities who would legislate against the motor vehicle. It will be a helpful factor, no doubt, in all the other praiseworthy objects which have been enumerated in these columns. Indeed, all these objects may be accomplished and yet it may fail of the highest good if one thing, more important than all the others, is neglected. We refer to the intellectual influence of the Automobile Club.

In the principal European countries there is a large leisure class who from mechanical taste or sporting proclivities are naturally drawn into the promotion of a new industry of such universal interest as the motor industry. Many of them are men of scholarly attainments, which find congenial exercise in various lines of original research connected with the new industry. Hence, there has grown up as a direct result of the foreign automobile clubs a class of able and disinterested critics and writers, well posted in different branches of the subject, and, because of their neutrality, exerting an influence which those directly interested in the manufacture or sale of motor vehicles could never wield.

It is this complete alienation from trade interests which has been largely instrumental in giving the principal foreign clubs the unique position they hold in their respective countries to-day. Adherence to the same policy is necessary if the New York Club is to attain a similar position in this country. But, above all, will its position finally be determined by its intellectual status, that is, by the value of the contributions it will make to the sum total of the scientific and commercial knowledge of the motor vehicle industry. Let sport and knowledge be pursued with equal zest and the best results will surely follow.

More Verbal Coinages.

Professor C. M. Woodward, of Washington University, St. Louis, Mo., is sending the following communication to the leading newspapers:

Is it not possible by concerted action to prevent the infliction upon a much suffering world of that latest product of the language factory—the word automobile? The word, or something to take its place is inevitable, and in the interest of economy of energy, time and space, it becomes us to adopt a shorter and an easier word.

The professor then goes into a long etymological discussion ending with the suggestion that the second half of the word "automobile" be discarded, and the new vehicle be called on "autom."

Of all the freak words that have been offered by verbologists to describe the motor vehicle this is about the worst. Fortunately the people and not the professors constitute the final court before which all verbal candidates are tried. Otherwise we should have a language composed of dead roots, which nobody, not even professors themselves, could understand.

Time proves all things, and it will not be long before the learned terms will be confined to the study and the shorter and more intelligible Saxon will hold the field, for in work and in pleasure, i. e., in action, the Saxon tongue predominates.

New York-Irvington Contest.

Letters addressed to the leading manufacturers of steam and gasoline carriages, inquiring whether it was their inten-

tion to compete in the New York-Irvington contest, organized by a company making steam carriages, have brought forth negative replies in every instance. Various reasons were given. Some said they did not manufacture steam carriages, implying that they looked upon the code of points as favoring vehicles of that class, others said they were too busy making carriages for ordinary use to build racing machines and still others took the stand that races were not wanted at all.

On the whole the interest in road races in this country at the present time appears to be decidedly lukewarm, and unless there is an extraordinary change of mind before the 20th of July the chances of a contest are decidedly dubious.

Ownerless Horses.

One of our correspondents last week called attention to the number of horses he encountered unattended in the street on a recent motor outing, and suggested that owners of motor carriages and the public in general needed protection from these "ownerless" beasts.

To leave horses unhitched in the streets or to permit them to make their way alone in the streets, as is frequently done, is criminal carelessness and a violation of law. Runaways from this cause are numerous, and it is the duty of the police to seize such animals and remove them from the streets, or to arrest the drivers. The laws regulating the use of horses in the streets are not enforced as they should be.

Willing to be Convinced.

President Clausen, of the Central Park Commissioners, New York, is said to have so far relented in his attitude toward the motor carriage as to be willing to take a trial spin through the park with some member of the Automobile Club, in order to see how the horses will regard the newcomer.

President Clausen ought not to wait long for an invitation.

Barred from Bar Harbor.

The motor carriage has been virtually barred out of Bar Harbor, Me., the aristocratic summer resort.

Under the present laws it is not legal to pass a law absolutely prohibiting their use. The by-laws passed to-day make it impossible for an owner of a motor vehicle to run his machine in Bar Harbor during the hours from 10 a. m. to 10 p. m., and only on little lanes and alleys at a speed not greater than five miles an hour and then only after the machine has been licensed.

After passing these by-laws, which referred to any vehicle propelled by machinery, it was suggested that the regulations adopted made the running of a road roller illegal, so the citizens passed another by-law to permit such machines to be used.

Incrustation and Corrosion of Boilers of Steam Vehicles.

By Robert I. Clegg.

The efforts of motor vehicle designers to discard all unnecessary weight has resulted in the adoption, in some cases, of steam boilers of most unusual lightness in this branch of engineering, and many persons, who are no wise alarmists, are rightly inquisitive as to the action of such boilers under the conditions of everyday use.

THE PERSONAL EQUATION.

It is in cases of this kind that one realizes the importance of the personal factor. One person may give himself little or no concern as to matters that do not actually obtrude themselves upon his notice while another will adopt the policy from the start of using his engine and boiler with the care he would give to a horse, obtaining thereby the maximum service. As might be expected it not infrequently happens, however, that the zeal of the latter is unsupplied.

The winter calls to mind one owner of a small engine and boiler, whose desire to improve the feed water conditions led him to sad conclusions. He proposed to filter the water by covering the tank with sacking through which the supply would pass. In theory this is good and in practice it apparently worked like a charm until the lint wore off the sacking and choked the pump by clogging up the $\frac{1}{4}$ -inch suction pipe at the elbows. The cause of the trouble was not obvious, and it puzzled the owner; not enough water could get through to supply the boiler yet, on the other hand, a sufficient quantity would leak past the obstruction to be in evidence when the air pet cock was opened at the feed pump, and it would seem that a leak in boiler or feed water heater must account for the deficiency.

While a filter—say a strainer of fine gauze—may remove mechanically, matter held in suspension it is practically useless with material retained in the form of a solution and it is with this we must deal if we wish to avoid injury from corrosion or incrustation.

Incrustation is the sediment or deposit which is separated from water when steam is evolved by the application of heat. The boiler receives and often permanently retains this mineral matter, forming a layer adhering to the inside of the shell and around the flues and tubes.

Corrosion is the term applied to the action of acids, oxidation, mechanical and galvanic agencies upon the shell and other parts of the boiler.

PROTECTIVE VALUE OF INCRUSTATION.

It should be mentioned here that if the incrustation could be restricted to a very thin layer it would protect the surface of the metal from internal oxidation and present on the other hand no very serious detriment to the actual heating capacity. Owing to the difficulty of properly limiting the action of the one to the other this is seldom deemed feasible, though no doubt such protection accounts for the seeming vagaries of boiler piping, etc., the corrosive action being much greater in some places than in other parts of the same boiler.

Owing to ease of working and its susceptibility of finish, etc., brass piping is likely to be freely used in connecting boilers with the other steam appliances. Brass is objectionable, however, for high pressures in that it softens and loses

its strength at temperatures that have no sensible effect upon iron. In fact, to quote an article in the *Locomotive*, written by the expert of a leading insurance and inspection company.

DEFECTS OF BRASS FITTINGS.

"We do not say that a brass blow-off on an externally fired boiler, is bound to give way, but we do say that alloys of this sort are unreliable, and that they are quite likely to fail without notice."

The British Admiralty Board examined the effects of temperature upon the tenacity of alloys some time ago. It was found that brass showed a marked loss of tenacity and ductility of about 250 degrees Fahr., while at 350 degrees the change was so pronounced that the material was no longer safe when exposed to any considerable strain. To understand the significance of this statement one needs but consult a table of the properties of saturated steam; thus a temperature of 250 degrees corresponds to a gauge pressure of only 15 pounds and a temperature of 350 degrees corresponds to about 120 pounds. The experiments were made upon cast brass and it is quite likely that the effect upon drawn tubing may be considerably less for a like period. In the end the result is the same, however, and it is therefore advisable to use heavy fittings, if brass is to be used at all. Brass is not only objectionable when actually under pressure but it rapidly deteriorates in service. The writer has removed brass blow-off pipes where a decided change in the material had taken place and the pipes had become porous and brittle.

Of the several steam boilers for motor vehicle use which the writer has examined personally, the Stanley is an upright tubular generator, both shell and tubes of copper; the Whitney has the shell and heads of steel; the "Alifu" of the Liquid Fuel Engineering Co., is of the water tube form, tubes of copper and the connecting manifolds of heavy ordnance bronze, and the generator on the Cross wagon consists of blind—one end closed—iron tubes screwed into a steel water back. Each of these has been described in *THE HORSELESS AGE* already and further comment upon the details of construction is needless, other than to state that each is well made and, with fair care, likely to furnish good results for a lengthened period. When new they will be highly efficient; how shall we continue their good behavior for the future?

CORROSIVE ACTION OF SOOT.

Soot contains eroding acid which will act upon certain metals, but it is easy to arrange for cleaning either by a jet of steam or some other hand operated device. Motor vehicle boilers are so limited in dimensions and weight that any of the many patented mechanical separators for removing incrusting earthy material seem out of the question and we are perforce compelled to seek either a chemical compound suitable to the water we are using or rely upon frequent blowing off the water. Here again judgment must be exercised. First the chemical should not contain any acid likely to cause or increase corrosion, and if the chemical is adapted to a solution in a certain locality it is of doubtful efficacy, owing to differences in geological formation, at a comparatively short distance therefrom. Again, if the boiler is blown off while more or less heated, some of the sediment is liable to adhere and bake on the tubes permanently. The writer sent a brief draft of the foregoing to a prominent inspection company of Hartford, suggesting the use of a petroleum product, preferably kerosene, as a conveniently obtained

boiler compound; and commenting upon the use of rain water as a scale solvent as has been advised by two manufacturers in *THE HORSELESS AGE*; the reply is well worth quoting.

AN EXPERT OPINION.

"The problem which you suggest is one which will no doubt come up in connection with the use of steam in horseless carriages. We have already had our attention called to this matter by some of the parties who are constructing such vehicles. It is a pretty difficult problem to decide, what is the best thing to use for the purpose of removing scale in boilers. You know that the constituents of soils and the rock sub-stratums are oftentimes of very different qualities, even within short distances, so that a remedy that would operate in one case may be entirely inoperative in another case, but we have found in our wide experience that kerosene used modestly and moderately, dropped into the feed water not excessively, has been very effective in keeping boilers in good condition, and particularly so with carbonate of lime scale, and perhaps we may say also, in sulphate of lime scale. It should not be used in too large quantities, but just enough to let the boiler feel the influence of it. In most of the boilers which are to operate horseless carriages, kerosene is used as fuel, so that it would not be a difficult matter to drop, or have an arrangement by which a little could be put into the boiler occasionally, not a large quantity, but sufficient to have influence left when the boiler is filled and then, as you have already said, it would be well to blow the boiler out and wash it out thoroughly. We would not regard it as advisable to blow out under a high pressure of steam and then fill up with cold water—that would ruin the boiler—but let the boiler become comparatively cold and then let it run off and after it has cooled down sufficiently wash it out thoroughly with a hose or a stream of water. If the sediment is removed frequently, there will not be an opportunity for scale to form. One of the difficulties with large boilers in steam plants is that they are not opened oftener than once in three or four weeks and sometimes longer, consequently the sediment that may be in any of the water which is used, settles on very hard, but we are of the opinion that in these small boilers, if the water is frequently blown out, that is every day or every day or two, the difficulty of scaling will be greatly overcome.

Rain water is, of course, a good, pure water, not liable to make scale, but there is such a thing as having water too pure. That would almost seem to be impossible; but sometimes with the purest of water corrosion takes place. The oxygen in the water attacks the iron or steel of the boiler so that taking into account that these carriages are to run from place to place where there are different qualities of water to be used in filling the boiler or the water tank, our own impression is that a little kerosene used in the boiler as it is about to be filled, will greatly aid in preventing the formation of hard scale and in assisting to deposit any sediment which may be held in the water so that it can be easily washed out with a hose."

The phrase, "a little kerosene used in the boiler as it is about to be filled" simply refers to admitting a small quantity into the empty boiler, then when water is turned on, the oil floating on the surface gradually coats the metal as the boiler fills.

There is undoubtedly a field for the steam motor vehicle, the flexibility of the motor as to gearing and reversibility, etc., the well known character of most of the appliances connected therewith and their practicability under varied conditions all combine to give a certain degree of confidence, but there is nothing to be gained by ignoring the disadvantages of steam, almost wholly limited to the boiler, and it is in a brief way to point out some of these objections and their relative importance as well as to suggest such expedients as experience has found beneficial, that the foregoing summary has been written.

LONDON NOTES.

LONDON, June 25th.

NEW BELGIAN LIGHT PETROLEUM CARRIAGE

We are able to give herewith two illustrations of the two-seated petroleum motor carriage lately put on the market by the Fabrique Nationale d'Armes de Guerre of Herstal, near Liege, Belgium. The vehicle has a very neat and elegant appearance, the frame and body being supported on the axles by strong plate springs. The motor is a vertical one, having two cylinders. It is of 3 H. P. and weighs about 100 pounds. It is located in the front portion of the vehicle, facilitating the cooling of the cylinders, so that no jacket is used. The ignition is electric, the spark employed to ignite the charge being an induced one. From the motor shaft power is transmitted by belts to an intermediate shaft, and from the latter to the rear axle by the usual sprocket wheels and chains. The variable speed gear is controlled by a single handle mounted on the steering standard. By means of the belt transmission and the regulation of the spark, it is claimed tires. The front wheels are mounted on the usual short vertical that any desired speed from 0 to 22 miles an hour can be obtained. The wheels are of the cycle type, with pneumatic tires. The front wheels are mounted on the usual short vertical pivots, the steering being effected by means of a hand wheel. Provision is also made so that the motor can be started from the seat. The little carriage, which can, if necessary, be provided with a small additional seat in front, weighs, complete, less than 500 pounds. Both from its neat design and also by reason of its relatively low cost—about \$700—it is meeting with a large demand. The Fabrique Nationale informs us that, owing to the large number of orders already booked, they cannot undertake to furnish any more carriages before the beginning of next year.



THE NEW BELGIAN CARRIAGE.



FRONT VIEW OF BELGIAN CARRIAGE.

The German Touring Club, which is about to hold its annual meeting at Mainz, the proceedings extending from the 14th to the 20th of July, is making a new departure this year, having decided to organize a road race for motor carriages and motor cycles. The distance is about 150 miles, the course being from Mainz to Coblenz and back via Finthen.

An indication that horseless vehicles are coming into prominence even in Norway is to be found in the announcement just made that the customs authorities have just altered the classification "electric motor vehicles for use on railways" to include all kinds and types of motor vehicles, the duty on which on importation into Norway is about \$2 each.

The formation of the Societa per la Costruzione di Automobili is reported from Padua, Italy, with a capital of £16,000. This is the third or fourth company which has been formed in that country in connection with horseless vehicles.

Information reaches here from Cologne, Germany, of the formation in that town of a company bearing the title Die Allgemeine Betriebs Gesellschaft fur Motorfahrzeuge, to deal in horseless vehicles of all kinds and to establish public motor services for the conveyance of both passengers and freight. It is stated that the Cologne Electrical Co. (Welter & Co.), is interested in the new concern, which has a capital stock of \$150,000.



STANLEY-WHITNEY STEAM CARRIAGE, STANLEY MFG. CO., LAWRENCE, MASS.



THE EASTMAN ELECTRO CYCLE.

Across the North American Continent by Motor Vehicle.

During July Mr. and Mrs. John D. Davis, representing the *New York Herald* and the *San Francisco Call* start from New York City for San Francisco in a Duryea touring cart of heavier construction than ordinary to stand the wear and tear of country roads.

The journey, which will be the longest ever undertaken by motor carriage, will cover 3,700 miles, the route lying through Albany, Syracuse, Rochester, Buffalo, Erie, Cleveland, Toledo, Chicago, Davenport, Des Moines, Omaha, Denver, Ogden, Sacramento and San Francisco. Through the Rocky Mountains stage coach routes and cattle trails will be the best roads available, and it is probable that quite a number of rivers will have to be forded.

The carriage which will be employed is the latest product of the National Motor Carriage Co., of New York. Its total weight, passengers and luggage included, will be about 1,200 pounds.

Motor Mail Wagon in Use.

For the first time in the United States a motor wagon was used last week in collecting the mails. The place where the trial was made was Buffalo, N. Y., and the territory chosen was covered in half the time a horse had been able to do it.

The trial will be continued.

A Novel Tire Inflating Device.

A New York gentleman who owns a motor carriage and has natural mechanical taste, has devised a very simple but ingenious method of avoiding the disagreeable task of pumping up his pneumatic tires. He took a galvanized iron stove boiler and fastened it up in his barn at a convenient distance from his motor carriage. He then connected the lower part of the boiler with the city water supply and put a pressure gauge on top of it. The pressure of the water pipes is 120 pounds, which he reduced to 60 pounds by means of a valve. When he wishes to inflate his tires he turns the valve and lets water in until the gauge records 60 pounds, then attaches a tube to the outlet in the boiler and in a twinkling he has 60 pounds of pressure in his tire without the labor of pumping.

No Permit for Motor Carriages in Central Park.

Although it had been supposed that the Commissioners of Central Park, New York, were simply waiting for some member of the New York Automobile Club to petition for a permit to drive his motor carriage in Central Park, such a petition was refused last week on the ground that it might frighten horses and would be a "disfigurement to the park."

Legal action will be taken by owners of motor carriages.

'COMMUNICATIONS.

The Eastman Electro Cycle.

CLEVELAND, O., June 26, 1899.

Editor HORSELESS AGE:

In the May 13th number of the *Scientific American*, under the heading, "Some Early Forms of the Automobile," a writer sets forth some very interesting statistics, and in the light of his researches quite a new point of view is presented of the present horseless vehicle movement.

From the data given us in this article we are shown that with the first discovery of steam as a motive power the then new idea was tacked on to the old, and the steam coach, crude and unwieldy, was the result, and thus ante-dated the locomotive of the railroad.

Track propulsion, however, offering more practical and profitable advantages, than road propulsion the lumbering steam coach was very soon abandoned, and the evolution of the locomotive began. The wonderful strides in the evolution of the locomotive up to the present perfection will be interesting to study as they will offer something analogous, or as an index of what is before us in the future development of the second attempt to place power vehicles upon the road. In the April 12th edition of THE HORSELESS AGE, the editor says, "It was long ago pointed out that the chief danger of the motor vehicle designer was the horse vehicle, which by force of habit must be ever before him, and which must be entirely forgotten before a practical motor vehicle can be designed." And right here the writer begs leave to say, that it does seem that if we again fall into the error of attaching power to the old forms of horse conveyance we shall a second time be compelled to abandon the field to the superior advantages of track locomotion.

There has been but only one motor vehicle that has survived the test of time and our abominable roads, and which is here to stay, and that is the bicycle. The bicycle is the first true motor vehicle. Never intended for horse or steam, light, strong and swift, the bicycle has developed, the perfection of power transmission because man himself furnished that power, and the ideal of steering construction because the self same man's neck depended on sure and instant control.

The bicycle, it is the writer's belief, was the pivotal incentive that has again inspired invention to solve the problem of self-propelled road vehicles and must be the starting point in the evolution of the new automobile that is to come and stay.

The bicycle taken as a whole embodies grace and completeness, yielding a maximum of speed with the expenditure of a minimum of power, and these features it seems to us are eminently essential in the automobile.

The Eastman Electro-Cycle is built along the lines of the bicycle, could in fact be called a bicycle carriage. The frame is of steel tubing, the side panels of sheet steel muffled and insulated so as to be noiseless and practically indestructible. In its construction is extreme lightness (it is the lightest electric carriage in the world), combined with wonderful rigidity. The battery and motor being more than three-fourths its entire weight, it will readily be seen, that with only one-fourth its weight to propel, these agencies are allowed their fullest effectiveness. Three speeds forward, one backward, with a coasting motor brake are all operated with one lever; there

is a powerful band brake operated by the foot, and the steering is accomplished by handle bars and a steering head, as in the bicycle. Three wheels ride lighter and with greater steadiness than four, there being one less to bump the inequalities of the road, and three wheels steer out of ruts and over car tracks as four can never be made to.

Patents upon its entire construction as well as its general design have been applied for. H. F. EASTMAN.

A Criticism on "Grades and Horse Powers."

HOLMESBURG, PA., June 27.

Editor HORSELESS AGE:

I was much interested in the article and table on "Grades and Horse-powers," by Harry E. Dey in THE HORSELESS AGE for June 14th.

I note that according to the table, the power required on the level is proportional to the speed; that is, to double the speed, the power must be doubled; to increase the speed ten times, the power must be increased ten times and so on. When studying physics many years ago, I was taught that to increase the speed of a moving body the power must be increased proportionally to the square of the speed; that is to say, to double the speed requires four times the power; to treble the speed requires nine times the power, and so on.

I call attention to this matter not in a spirit of criticism, but with the view of obtaining information. I should much like to see this subject discussed in THE HORSELESS AGE.

Yours truly,

WM. H. MORRISON.

I think Mr. Morrison has confounded the air resistance with traction resistance, as the former does follow some such rule, but the latter is practically constant, at least on smooth roads. Below twenty miles an hour the air resistance is very small compared with the traction, but above that speed it becomes a more important factor. I left it out of consideration in the table, as, expressly stated in its accompanying article, to incorporate it would require a separate table, based on surface presented in place of weight, and as the wind is such a variable quantity in direction and force it would be practically guess work to use it.

HARRY E. DEY.

A Discrepancy in Figures.

LONDON, June 19, 1899.

Editor HORSELESS AGE:

DEAR SIR—There is a very interesting account in one of your recent issues of an American motor pacing machine, but the inventor has evidently never tried his machine on the track, nor has he taken care to see that the figures he has given to the press are correct.

For example, he says that his motor runs at 2,200 revolutions a minute. He gears it down in relation to the wheels in a ratio of ten to one, and then claims that it will travel at forty miles an hour.

Presuming that the driving wheel is twenty-eight inches, which is most likely (for even if it is two inches one way or the other, it makes very little difference in the calculations), his calculations are wrong to the extent of more than doubling the speed at which it will really go, as the number of revolutions he gives and the ratio of gearing will only give him about nineteen miles an hour.

Yours truly,

S. F. EDGE.

New York-Irvington Race Code.

IRVINGTON-ON-HUDSON, N. Y., June 26, 1899.

Editor HORSELESS AGE:

I understand that some objection has been raised to the scale of points suggested in the offer of a \$2,000 prize, made by Mr. Barber and myself for horseless carriages in competition. Permit me to call attention to the fact that under the terms of our offer, General Miles and his committee have full power to change the scale of points; and if their attention is called to any injustice, I have no doubt they will take great pleasure in correcting the scale to correspond with the equities of the occasion.

Yours sincerely,

JOHN BRISBEN WALKER.

Investigate!

BOSTON, MASS, June 27, 1899.

Editor HORSELESS AGE:

I write to ask the opinion of your engineer on the desirability and the demand of the following described device: A clutch for an automobile, one part of which is the hub of the wheel, the other part attached to the axle. The device is to clutch forward or backward and permit the wheel to run free when the wheel revolves faster than the axle.

Yours truly,

S. A. B.

[We refer the inquirer to the article on the differential gear by Leonard Huntress Dyer, page 7, issue of June 28th.—ED.]

New Stanley-Whitney Steam Carriage.

The new Stanley-Whitney steam carriage manufactured by the Stanley Manufacturing Co., Lawrence, Mass., is now ready for the market. It is intended for two persons, but by the use of a back seat and a turn down foot board, it can be used to carry four persons, seating them back to back.

The carriage, which is equal in workmanship to the best coupe work, is an open one, but a shay or canopy top can be added, if desired. Its weight is about 850 pounds.

The steam is generated in a small tubular boiler by the means of a gasoline flame in such a way that the escape of the steam is not noticed, and no loud noise is made by it.

Enough water (22 to 23 gallons) can be carried for a journey of twenty-five or thirty miles, depending upon the grade of the road traveled, and enough gasoline (eight gallons) can be carried for a journey of 80 or 90 miles. The supply of water to the boiler, and the supply of gasoline to the burners is practically automatic. While running the carriage, therefore, very little attention to the supply of water and oil is required.

The steering is accomplished by the use of a handle bar, moved to the right or the left. Steam is let on or turned off by means of this same handle bar, which for this purpose is used by turning the handle only, by the turn of the wrist—the motion one way letting on the steam, and the motion the other way shutting it off. To reverse the engine and back the carriage, it is only necessary to pull the handle bar backward and then let on the steam. The engine cannot be reversed while the steam is on, because the action of drawing back the handle bar shuts it off, and after the handle bar has been drawn back, it is necessary to let on the steam again.

Under the foot is a double powerful brake, sufficient for the steepest grades. In front of the driver, on the dash-board, is placed the steam and gasoline gauge, so that he has in sight all the time the working pressure of both the steam and the gasoline. In a mirror on the dash-board the reflection of the water gauge is seen showing the height of the water in the boiler.

The speed of the carriage is ordinarily ten or twelve miles an hour, but a much higher rate of speed can be obtained, if desired. The driving mechanism from the engine to the rear axle is so arranged that in going over rough and uneven parts of the road, the working parts are not thrown out of line and caused to run hard and wear badly.

The engine, composed of two cylinders (acting on the same shaft), can be started in any position. By the use of a special device, steam is always let on very gradually, which causes the carriage to start very gently and without any sudden jump.

The difference between the new model and the old Whitney carriage is principally in superior construction, but there are quite a number of constructional details improving its efficiency and strength. The frame is so constructed that the boiler and engine are now carried upon it, and are not in any way attached to the wood body, which is now separately attached to the frame, and can be easily removed, exposing the whole frame and machinery intact. This is a decided advantage in getting at the machinery to adjust it, when any changes or repairs are required. The chain and sprocket is of a much stronger and improved design, and will not show the wear of the former chains and sprocket. The brake has been made stronger, and the leverage more powerful. The steam and air gauge has been combined in one very neat case, an improvement due to the Steam Gauge Co. The arrangement of the burners under the boilers has been much improved. There are now three injectors, the central one being independent of the others, and the two outer ones connected with a diaphragm, which is controlled by the steam pressure. In this way, the flame is reduced automatically, whenever the pressure of the steam reaches a certain point, as may be desired. The central burner is, however, not connected with the diaphragm and remains undisturbed, even if the flame is entirely shut off from the two other burners. If the flame is shut off from the two outer burners, upon opening the stop cock of the burners, the flame from the central burner will light automatically the two outside burners. This arrangement, as will be understood by those who have used a steam carriage, is a great convenience.

The photo gives rather an incorrect idea of the size of the wheels, for, as a matter of fact, the front wheels are smaller than the rear wheels. The carriage which Mr. Whitney took with him to Europe is not like the one shown in the photograph, as that wagon was made especially light, and its power was increased to give it the necessary speed for racing. Mr. Whitney will probably take a number of prizes.

Dr. Samuel L. Thorn, of Toledo, O., believes he has found the proper word to designate the motor vehicle in "autogo," which he says, like "kodak," can be easily adopted. This is certainly one of the very worst attempts at verbal invention that ever violated the laws of language and of common sense. We suspect the doctor is a humorist.

The Storage Battery.

By Harry E. Dey.

If we take two pieces of platinum and place them in a dilute solution of sulphuric acid, and connect them to the terminals of a dynamo, or other source of electric current, gas will be noticed freely bubbling up from each; the water is being decomposed into its original elements (oxygen and hydrogen), the oxygen is given up at the positive pole, and the hydrogen at the negative, the quantity of the latter gas being twice that of the former.

If we disconnect the generator, and connect the platinum terminals to an electric bell, it will cause it to ring for a short time. This is due to the fact that the gases clinging to the plates recombine when the circuit is closed and form water once more, and in doing so they produce an electric current in an inverse direction to the charging current.

If we substitute two pieces of sheet lead for our platinum and repeat the experiment, it will be noticed that the gas does not immediately come off, and is delayed much longer on the positive terminal than on the negative; and when we look at the plates we will find the positive turned a dark reddish brown color, while the negative has a clean blue slate color. This is because the oxygen at the positive pole combines with the lead, forming peroxide of lead, while at the negative the hydrogen has reduced the light oxide, due to air exposure, and left the surface pure lead. It will ring the bell as in the first case. If now we change the terminals so as to reverse the charging current, it will be a considerably longer time before the gas makes its appearance, the color of the two plates will be reversed, and the bell will ring a longer time, the oxide on the one plate will be reduced to spongy lead, and the other plate oxidized. By frequent charging and discharging, and occasionally reversing, the plates will be affected deeper and deeper until they reach their maximum capacity, which is when they are acted on so deeply that they begin to fall to pieces, or the scaling from the surface equals the rate of formation.

The original storage battery, invented by Gaston Planté, was made of sheet lead formed in this manner, and there are many batteries on the market at present made on this principle, the majority of them being made from slabs of lead grooved on both sides so as to afford as large a surface as possible, and the coating formed on the inside of the grooves has not the opportunity to fall off which it is so subject to on a smooth surface. Several different methods are taken to hurry up the formation. One is to boil the plates in a one per cent. solution of nitric acid before forming (Epstein's patent); another is to soak for twenty-four hours in a 50 per cent. solution of nitric acid preliminary to forming. This method was used by Planté. Another method is to add an ounce or two of acetic acid to the electrolyte while forming (the latter having a very powerful oxidizing effect), but care has to be used to prevent forming acetate of lead. It operates much better if zinc is used for the negative element while forming; amalgamation also aids in oxidizing, but it is hard to get rid of the mercury afterwards. It will be seen from the foregoing that a storage battery does not store electricity as generally understood by the public, but in reality produces chemical changes in the plates and electrolyte, which, when the conditions are reversed, change back to their original condition, and in doing so produce electricity. When discharging they are to all intents and purposes a primary battery. Many

primary batteries may be recharged by sending a current through them in opposition to their discharge current. When a storage battery discharges the per-oxide becomes a lower oxide, and the spongy lead a low oxide, the tendency being to equalize, but this is never reached in practice.

In the early eighties M. Faure, in France, and Charles F. Brush, in the United States, hit upon the idea of coating the plates with a ready formed oxide, which would save the long process of formation, besides allowing any depth of active material desired. They applied red lead (which is a high oxide) to the positive plates, and litharge (a low oxide to the negatives. A short charging would then change them to per-oxide and spongy lead respectively. This was a great improvement over the original Planté method.

To retain the active material, as the per-oxide and spongy lead are called, the support plates were made somewhat similar to a honeycomb, the apertures extending all the way through the plates, the thickness of plates being from 3-32 inch upwards, seldom exceeding ¼ inch in an ordinary cell, the positives being usually thicker than the negatives.

The Planté method was never patented, consequently is open to anybody to use. The "pasted" plate has very broad patents, and they are owned by the "Trust."

The cell known as the "chloride," also owned by the "Trust," is made by taking lead chloride and mixing with a given proportion of zinc chloride, afterwards melted and cast into small squares. These are then placed in a suitable mold and an alloy of lead and antimony is cast about them under high pressure, thus fixing them in a firm lead frame, or grid. These plates are next immersed in a dilute solution of zinc chloride, together with plates of zinc, the latter being in metallic contact with the former. This is equivalent to a short-circuited primary battery couple, and results in the removal of the zinc chloride and chlorine of the lead by electrolysis, so that the frames contain only the residue of spongy lead, which are then formed in the usual manner.



FIG. 1.

LEAD PLATES.

The writer has had better results from that known as the lead-zinc type than any other. The positive plates of this battery are of the per-oxide style, but the negative have zinc for their active element, which gives over twenty per cent. higher voltage than spongy lead, besides being so much lighter for a given capacity, a pound being good for about 200 ampere

hours. Some other metal, as copper, is generally used for a support, the zinc being plated on it. On discharging, the zinc goes into the solution and forms zinc sulphate, and in charging goes back to the plates. The electrolyte is the same as used in the lead cells (sulphuric acid 1.20 sp. grav.), with zinc oxide or metallic zinc dissolved in it. The copper supports are light, being made up of thin perforated sheets of copper. About a pound of mercury is placed in the bottom of the cell and creeps up the copper-zinc plates by capillary attraction, the lead plates being given a large clearance from the bottom, and also from the plates. The following is the description of a cell from which the writer obtained 115 ampere hours at a five ampere rate. It had a total weight of 13 pounds, being the lightest storage battery known to the writer. One hundred sheets of lead foil were laid between two

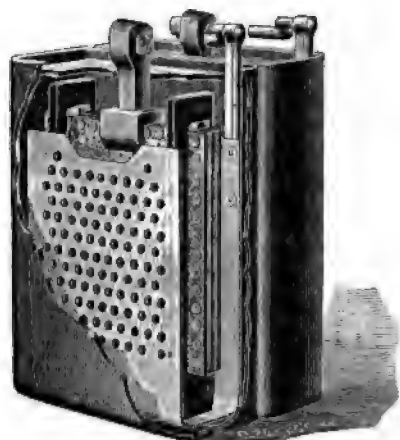


FIG. 2.
ASSEMBLED CELLOS.

pieces of sheet lead and riveted together with lead rivets, and punched full of one-eighth inch holes, one-eighth inch apart, making a plate after forming about $6\frac{1}{2}$ inches square, and one inch thick. This was placed between the sides of a U-shaped piece of sheet copper (which was afterward plated with zinc) and placed in a hard rubber containing jar containing a few ounces of mercury. The following table is a record of the discharge at a constant rate of five amperes.

Ampere hours.	D. P., or voltage on closed circuit.
0	2.45
5	2.45
22.5	2.39
27.5	2.38
32.5	2.38
40	2.37
55	2.37
60	2.34
70	2.31
80	2.27
90	2.23
105	2.21
115	2.00

This is a slow discharge, but they are capable of as high discharge as any of the lead-lead type. Discharging one cell 180 ampere hours were obtained, that is a nine hour rate; the same cell gave 120 amperes at a two hour rate, that is 60 amperes; another cell at 25 amperes gave 65 ampere hours; at 50 amperes 50 ampere hours.

These cells will stand a great deal of abuse, but they also require considerable attention as the zinc is liable to scale and short circuit, or dissolve from local action and leave the copper bare. When the latter happens it is sometimes very hard to get the zinc to take to it again. The lead plates in these cells never sulphate.

The writer has never used any of these cells on a motor vehicle, so does not know how successful they would be. Possibly there might be trouble in keeping the zinc on the copper on account of the jarring. These cells were made under the Main patents, and their construction is shown in Figs. 1 and 2.

Another type of cell is the zinc copper-oxide used experimentally a few years ago on the Second avenue street car line in New York City. The ampere hour capacity of this cell is enormous, being about three times that of the zinc-lead type, but as it has only about a third the voltage of the latter there is nothing gained by it. They require heating when being charged, consequently would not be very desirable for a carriage battery. They are based on the principle of the Edison-Lalande primary battery, zinc for negative element, oxide of copper for positive, and caustic-potash electrolyte. The retaining cells are iron.

When a lead battery is fully charged it gives off gas very freely, the liquid having a milky appearance from the large number of gas bubbles contained in it. Previous to that time the gas is hardly perceptible, as it is nearly all being chemically combined with the plates.

The acid in general use is sulphuric of about 1.2 specific gravity, this corresponds with about one-fifth acid and four-fifths water by measure. In mixing, the water must never be poured into the acid, but the acid into the water, slowly, constantly stirring at the same time.

A zinc-lead cell has an E. M. F. of about two and a half volts, a lead-lead cell about two volts, and a zinc copper-oxide cell about nine-tenths volt. In all cases, regardless of size; higher voltage is obtained by adding cells and coupling them in series, that is, positive of one to the negative of the next. Ampere capacity is gained by increasing the size of the cell, or by coupling them in multiple, that is, like poles together.

It is the common practice with vehicle batteries to seal them, leaving only a vent for the escape of gas. This is done to prevent slopping, but should be dispensed with as it is desirable to see the inside of a battery, and have it readily accessible if it gets dry or the acid becomes too weak, or too strong, or the plates become short-circuited, or any one of the numerous other things happen, which should be attended to promptly.

By making the cells small in area but deep, there will be little if any trouble from slopping, unless the carriage is upset. A good way to accomplish this is to use a compartment cell, that is a jar containing six or eight cells partitioned off, using enough of these to bring the E. H. F. up to about 352 volts. This allows charging from a railway 500 volt circuit, without much rheostat loss, and by connecting in multiple-series a 220 volt circuit may be used. Splitting this in half gives 88 volts, suitable for an 110 volt circuit. The speed controller will give these combinations. A high voltage can be obtained for practically the same weight if the batteries are specially designed for it.

In electric launches a jelly electrolyte has been used, how satisfactorily I do not know. The only objections I know of are that the internal resistance is about doubled, and the

capacity is lowered from ten to thirty per cent. The latter, of course, is quite an objection.

There is one style of cell of which the writer has for years been hoping to hear good news and that is compressed gas. It is made up after the style of the ordinary lead cell, but provision is made to collect and keep under pressure (separated of course), the gases liberated after the plates are fully charged. The gases exerting their own pressure. As the pressure increases the voltage increases, and the ampere hours are increased according to the amount of gas collected. Such a battery would probably have a high internal resistance, but this could be overcome by a large surplus capacity, saving no weight, but obtaining a largely increased capacity with the same weight. It has been stated that as high as seven volts have been obtained with such a battery at 2,000 pounds pressure.

The writer has made plates from solid active material, but does not recommend such, especially for such rough work as they would be subject to on motor vehicles. The plates can be made hard enough to stand any amount of rough usage, but at the expense of capacity, and quick discharging qualities. The highest results from these cells was about ten watts per pound which is about half the capacity of the above mentioned lead zinc cell.

OUR FOREIGN EXCHANGES.

The Critchley Clutch Gear.

The Automotor for June gives a description of a clutch gear, invented by Mr. Critchley, the mechanical superintendent of the Daimler Co. at Coventry. Referring to the accompanying drawing, the shaft, A, is the driving shaft taking power from the motor by means of a friction clutch, the sleeve carrying the four spur gears, C, D, H, and J, being keyed on this shaft, and engaging with four similar gears running loose upon the second shaft, B, this shaft giving motion to the driving-wheels through gearing at varied speeds as follows:

The first speed gear pinion, C, engages with the spur wheel, C₂, which is secured by bolts to the steel sleeve, E, which runs

loose upon the second shaft, B, and kept in position by the collar, G.

The second speed gear pinion, D, engages with the spur wheel, D₂, which runs loosely upon the steel sleeve, E, and kept in position on the sleeve by the segment ring, F, secured by the same bolts, C₂.

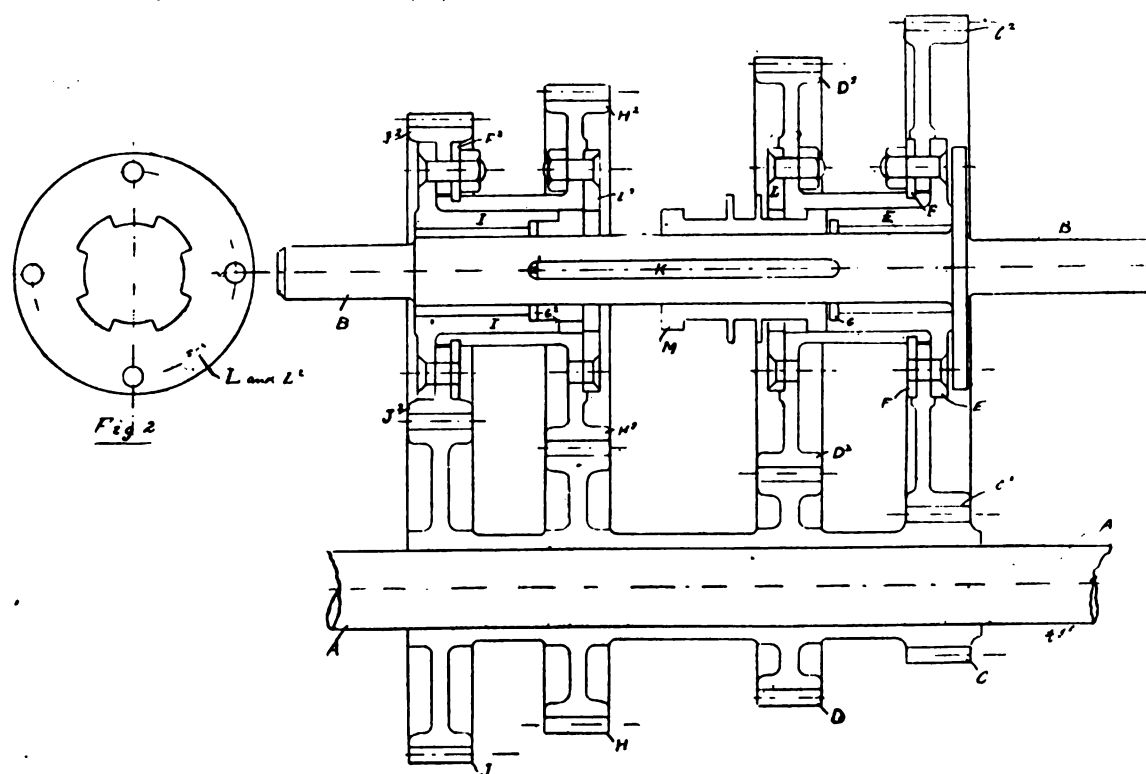
The third speed gear wheel, H, engages with the wheel, H₂, which runs loosely upon the steel sleeve, E₂, and kept in position by the segment ring, F₂.

The fourth speed gear wheel, J, engages with the spur wheel, J₂, which is bolted to the steel sleeve, I, which runs loosely upon the second shaft, B, and kept in position by the collar, G₂, the collars, G and G₂, being held in position by the feather key, K.

Upon the gears, D₂ and H₂, plates, L and L₂, are secured, having four or more teeth (Fig. 2) cut upon the inner side, the steel sleeves, E and E₂, also having a similar number of teeth cut upon the inner face.

The sliding clutch, M, is free to slide between the two sleeves, E and E₂, but is secured to the shaft, B, by the feather key, K, revolving with it, the clutch having upon its two ends corresponding teeth cut to engage with the teeth in the sleeve, E, or the plate, L, on the one side, or the plate, L₂, or the sleeve, E₂, on the other side, the clutch being actuated by levers placed near dashboard.

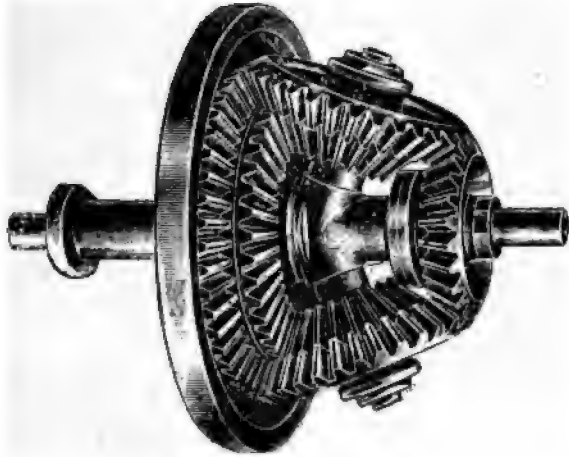
The clutch is shown engaged with the sleeve, E, which has the first speed gear, C₂, attached; therefore the shaft, B, will be driven at a relative speed to the shaft, A, through the gears, C and C₂. If the sliding sleeve be run along the shaft, B, and into a position that the teeth in the sliding clutch, M, engage with the teeth in the plate, L, the shaft will be driven at a higher speed through the gears, D and D₂, and by sliding the clutch further the opposite side will then engage with the gears, H and H₂ and J and J₂, and higher speeds will be obtained; the teeth on the clutch or upon the sleeves and plates may be backed off that the teeth may engage each other at once upon contact and thus prevent knocking, and so reduce wear and tear and also any noise. The whole of the gears run in an air-tight gear case, and run in oil, which reduces friction to a minimum.



Humpage's Epicyclic Reduction Gear.

This novel form of reduction gear, invented primarily for the back gear of lathes, can be applied equally well to motor vehicles. Fig. 1 is a general view of the train, and Fig. 2 shows the application of it to a lathe.

Referring to the latter figure it will be seen that the cone pulley is made with an internal boss, A, to which is keyed the

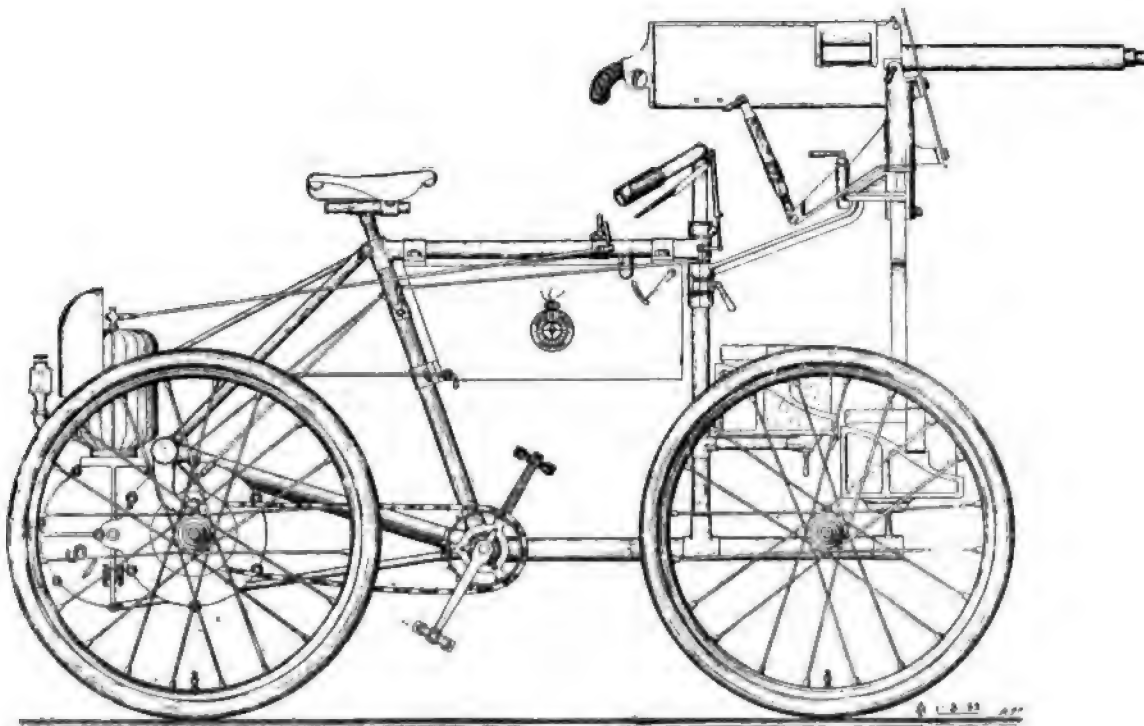


driving pinion, B. Upon the mandrel or shaft is a double-armed cross-head, C, the arms, D, D, of which are about 120° apart. This cross-head is free to rotate upon the shaft. On each arm are two wheels, E and F, which are pinned or keyed so as to rotate as one. Wheel G is keyed to the shaft, and wheel H is made with a large boss which is carried in the split bearing, J, and can be prevented from rotating by tightening the handle, K. The action of the gear, according to the *Mechanical Engineer*, is as follows: B gearing with E, which

in turn gears with H, and F gearing with G, when the cone pulley is turned B drives E. As, however, H is fixed, and cannot rotate, it acts as a fulcrum, and the wheels, E, F, and the cross-head, C, are forced to turn, the former on the arms, D, D, and the latter about the axis of the mandrel. This compound movement of the wheels, E, F, viz., of rotation on their own axes, and bodily around the axis of the mandrel, causes F to drive G in the same direction, at a predetermined speed, according to the ratio of the gearing. When it is desired to run in single gear the handle, K, is slackened, and the screw, L, tightened to grip the mandrel through a small gun-metal one without exchanging teeth. The gear is manufactured by pad. The whole gear is then locked together and rotates as than the rear wheels. The carriage which Mr. Whitney took Humpage, Jacques and Pedersen, Ashton Gate, Bristol, England.—*The Automotor*.

The Simms' Military Motor Cycle.

The British War Office is, however, we believe, considering the value of motor cycles for scouting purposes, and we give an illustration (see Fig. 1) of a motor quarricycle fitted with a Maxim gun and which has been designed by Messrs. F. G. Simms & Co., with a view to having its capabilities tested by the military authorities. As will be seen, the framing is of stiff steel tubing well braced together, and having a standard on the front upon which is mounted the gun and a light steel shield. The ammunition is carried in boxes placed on the framing in the front. If desired the gun can be dismounted and a seat substituted for it. A tripod mounting can also be carried if required. The wheels are made according to Messrs. Simms' design, and are fitted with their pneumatic tire.—*The Automotor*.



SIMMS' MILITARY MOTOR CYCLE MOUNTED WITH MAXIM GUN.

Motor Vehicle Engineering.

THE CRANK SHAFT OF THE STEAM CARRIAGE.

Fig. 1 is a sketch of a crank shaft recently turned by the writer for a three-cylinder steam carriage. As a slight error in the alignment of these shafts is very detrimental to the effectiveness of the power, it is customary to spend considerable time in getting the center true and the bearings as near in line as possible. Some of the cranks are made in sections, with the wrist pins screwed or otherwise fixed into place, thus affording the machinist an opportunity to operate upon the parts separately. The one-piece shaft, however, is preferred, and can be made by forging the piece a little larger all over than the finish size, and slotting the cranks with a slotter to the wrist pins, after which the metal between the slots is chiselled out. The shaft may then be put into a jig and the wrist pins and the ends and spaces between the cranks turned down true. A good jig for this work is made of wrought iron plate in the shape of a turning frame, one end of which is secured to the face plate of the lathe and the other bears on the lathe center. The crank is centered in this jig with the two cranks of one side in position to be turned at the wrist pins, after which the crank is shifted so as to bring the other crank and its wrist pin in the center for turning. After the wrist pins of the three cranks are turned true, the shaft is centered and the ends turned, also all places where an eccentric or other piece bears. These shafts are made of cast iron and wrought iron. Particular pains should be taken when turning that part of the shaft which is to carry the eccentric to make it stiff enough to obviate the danger of wobbling when in service. Some of the best shafts, so far as trueness is concerned, are rendered non-effective because of being turned down so much as to be too flexible. Lightness is an important item in motor vehicle mechanisms, but should not be carried to such extent as to make the crank shaft too limber.

THE ECCENTRIC.

The pattern of eccentric used is shown in Fig. 2, in which the novel feature is the mode of adjustment employed, consisting in the use of an adjusting screw and jam nut. This screw is indicated *b* and it is tapped into the inner and outer parts of the eccentric strap, as shown. There should be a jam nut provided for this regulating screw, so as to prevent its turning of its own accord. This arrangement makes it possible for the engineer to adjust the length of the rod with considerable nicety, and is simpler than the common design of adjusting eccentric strap in which keys and set-screws have to be re-arranged and placed several times before the correct adjustment is obtained.

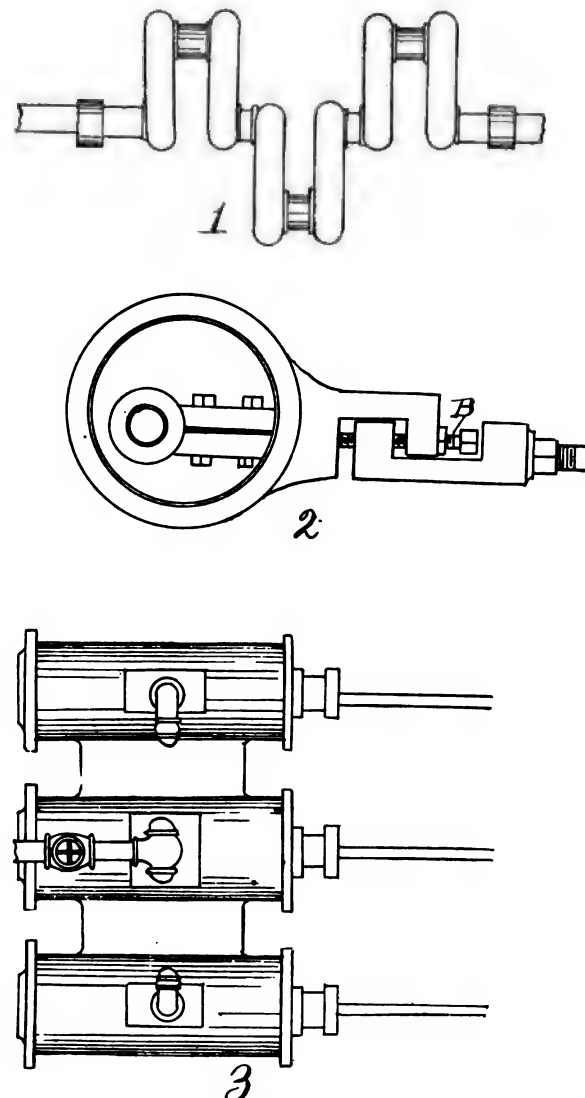
THE CYLINDERS.

In Fig. 3 is a drawing of the cylinders, three in number and arranged so that the center cylinder operates at high pressure and the other two at low pressure. The pattern is the plain slide valve. In overhauling or adjusting these cylinders, an examination should first be made of the levelness to ascertain if the cylinder bore is perfectly parallel and level. If not, it will be impossible to get effective service from the engine, and means should be taken to level the guides and connections. The cylinder bore should be level lengthwise, and crosswise, and should be parallel with the cylinder axis and at right angles with the flanges. Others, there will be binding of parts, loss of motion, heating and general imperfect service. The guides should be examined to see if they are in line with the

cylinder bore. See that the pistons are central with the cylinder bore, and perfectly tight at all connections. In most machines the cranks are set at the same height with the cylinder bore and the front cylinder flanges plumb.

CROSS HEAD.

In Fig. 4 is a type of cross head somewhat different from the ordinary design, in which the unreliable key is done away with. The trouble with the key method of fastening the rod is that the jar of the carriage frequently causes the key to loosen. A nut takes the place of the key, as shown, and a cotter is provided in the end of the rod, making a fastening which is very serviceable. The cross head is cored out for this nut, and this, of course, reduces weight a little without materially weakening the piece. The shoulder method of placing the rod in the cross head is not advised, but instead the end of the rod should be tapered as it runs into a similarly tapered hole in the piece.



BALANCING THE CRANK TO OVERCOME DEFECTS IN MACHINERY.

The writer usually employs the method shown in Fig. 5 to overcome ill-balanced engines. The out-of-balance engine of

any description is a serious defect in motor vehicles, as unsteadiness of motion not only occurs, but the carriage is likely to start hard and stop with difficulty. The balance of the engine can be determined by blocking the wheels and uncoupling the shafts. The balance may then be rectified by providing webbing for the upper or the lower portions of the cranks, as the case requires, as shown at the dotted portions at a, a and b in Fig. 5. This webbing is cast iron and made to fit around the parts where it can be secured with set-screws passing through the webbing and tapped into the metal of the crank shaft.

SPECIAL PIPE JOINTS REQUIRED.

The piping connection for carrying the steam from the boiler of the steam carriages to the cylinder necessarily requires specially designed connections, as all motor vehicle engineers know. The piping connections of a stationary engine and boiler in ordinary service can be butted, and if properly flanged and packed, will not leak. The piping of a vehicle steam power equipment is, however, subjected to certain mechanical motions and strains resulting from the action of the wheels on the road. This constant mechanical motion may not have its effect for a long time, and perhaps not at all on vehicles run at moderate speed over smooth roads. But it is safer to use wedged or dove-tailed joints in piping on heavy transportation wagons and other vehicles intended for service on pavements or rough country roads for the locking idea in these joints prevents the butts from shifting even if the flanges are loose. Fig. 6 shows one description of these joints in which the butts, instead of meeting square, are bevelled off with a file or grinding wheel, and therefore when adjusted, as shown, the interior pressure tends to bind the lap of one pipe over that of the other, aiding in preserving the firmness of the joint. The arrows c, c, indicate the direction of the pressure on the laps. In Fig. 7 is another form, consisting of the use of a rounded end fitted into a grooved end, as at d, d. Considerable jarring and mechanical strain would be required to upset this combination when properly flanged, while if the ends simply butted, the ends would shift as soon as the flange loosened, and perhaps cause an accident or delay from a leaky pipe.

THE STEERING GEAR.

Some types of steam carriages are provided with a single forward wheel and this is used for steering purposes, while other patterns are provided with two front wheels. Fig. 8 shows a good style of steering device for either description. The half gears mesh and are controlled by a shaft c, which joins to the shaft of a hand-wheel mounted at an accessible part of the truck. The flange g, of the back half gear is provided with a square channel and fits over the shaft or axle of the front wheel or wheels, being secured by set-screws. The supporting pin for this gear is marked f.

MOTOR VEHICLE ENGINEER.

WANTED.—Vol. 1, No. 1, Vol. 2, Nos. 5, 6, 7, 8, 9, 10, and Vol. 3, No. 1. A new number of the weekly will be given in exchange for any one of these, if in good condition, and for Vol. 1, No. 1, four numbers will be given if in good condition. HORSELESS AGE, American Tract Society Building, Nassau and Spruce Streets, New York.

MINOR MENTION.

The Grout Motor Carriage Co., Orange, Mass., have started up their new factory.

Osen & Hunt have secured the agency for the Victor motor carriage at San Jose, Cal.

The Mianus Electric Co., Mianus, Conn., are building an addition to their gasoline engine department.

The Media (Pa.) Carriage Works are building an electric motor carriage for Dr. W. A. Davis, Camden, N. J.

The Louisville Motor Vehicle Co., \$10,000 capital, has been organized by John E. Roche, George E. Roche and George G. Briggs.

J. Hector Graham, of the Graham Equipment Co., Boston, Mass., sails for Europe on July 5th to investigate the motor vehicle industry abroad.

A company, of which W. P. Cooper is president and Charles R. Lane secretary, has been organized at Fort Wayne, Ind., to introduce motor vehicles into that city.

Hamilton McKay Twombly, who owns 1,500 acres of land at Madison, N. J., has ordered a motor truck to carry his garden products to the New York market.

The Pittsburg Automobile Passenger Transfer Co. is being organized in the Pittsburg (Pa.) East End to carry passengers in districts not served by the trolleys.

The Baldwin Cycle Chain Co., Worcester, Mass., are now prepared to furnish motor vehicle chain of 1½ inch pitch and having space for tooth ¾ by 13-32 of an inch.

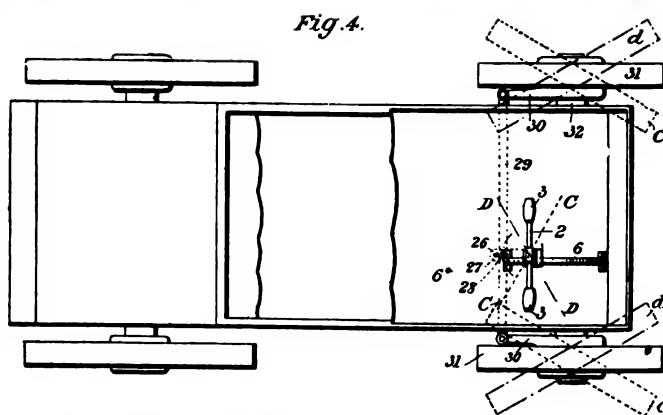
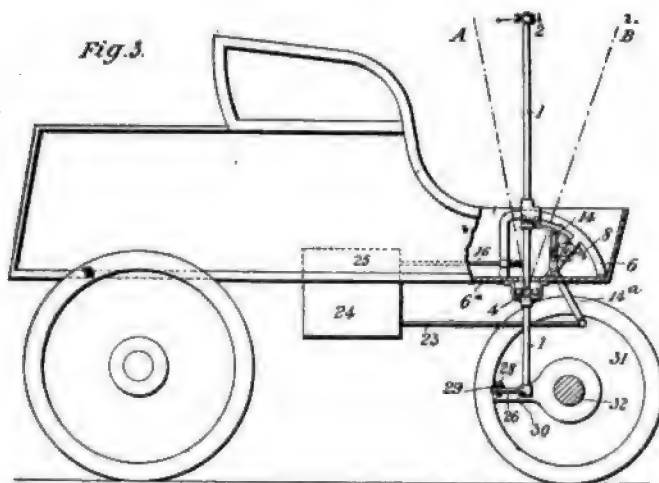
It is currently reported that John D. Rockefeller, the Standard Oil magnate, is heavily interested in the new Automobile Co. of America, recently organized to manufacture the Stanley steam carriage.

The Mississippi Valley Automobile Transportation Co., of East St. Louis, Ill., has been incorporated to manufacture and operate motor vehicles. The capital is \$500,000 and the incorporators are F. W. Abbott, H. R. Gamble and S. D. Rosenthal.

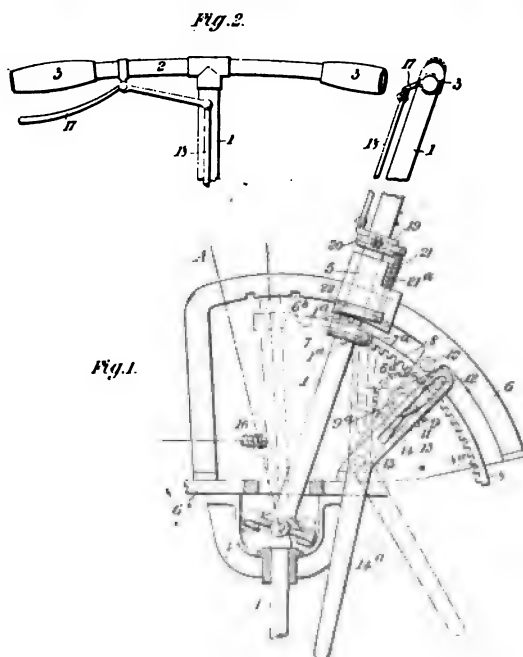
The Committee on Law of the Philadelphia Council, who have been requested to report on motor vehicle legislation to the general body, have sent to the United States Consuls for information in regard to such legislation in the principle European cities.

Joseph Cumming, secretary of the Mechanics' Institute, San Francisco, Cal., is endeavoring to arrange a motor carriage race from San Francisco to San Jose and return some time during the month of September, when the Institute holds its annual exhibition.

The Chicago Carette Co., Chicago, Ill., recently purchased thirty electric omnibuses, holding twenty passengers each, which will be put in service in September. They are open in summer and closed in winter, and have seats on top for smokers and sightseers.



power may be obtained by moving the steering-head proportionately away from the middle position forward for driving and backward for reversing. In cases where it may not be required to provide for reversing the most backward position



of the steering head and shaft may be that which switches or turns off the power.

"The device which is intended to be operated by means of the steering-head in order to regulate or control the power may, according to the particular power employed, consist of any mechanisms whereby the variations of motion of the car or the like from rest to the various degrees of motion in either direction may be substantially controlled by the to-and-fro movement of a single connecting-rod or its equivalent—for example, either of an electric resistance-switch and reversing-switch or of a four-way plunger-valve—so as to control the direction and amount of the flow of a fluid in a hydraulic or other motive-fluid circuit, or of jockey-pulleys in combination with running belts, or of the rod controlling the moving part of any variable-power device, or of any friction or positive driving clutch gear.

"The steering of the car, launch, or the like by means of the rotary motion of the steering-shaft about its own axis may be effected by a separate connecting-rod or its equivalent operating, according to circumstances, either by direct action upon the wheel-axle, as in a bicycle, or through the intermediation, for example, of a lever or a rack and pinion connected to an under carriage or to separately-pivoted wheels, or by means of a rack and pinion, lever, or other device acting on a plunger-valve, or in case of launches by means of chains connected with the rudder.

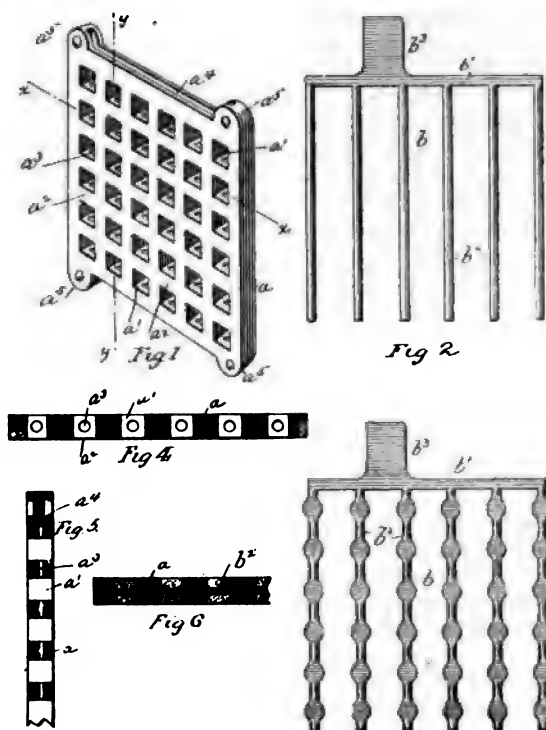
"In the cases where the gearing of the steering-wheel is such that the requisite movement is obtained by means of an angular movement of the steering-head not exceeding one hundred and eighty degrees I preferably use an ordinary bicycle handle-bar. Where it is necessary to move the steering-head through a greater angle than one hundred and eighty degrees, I construct the steering-head in the form of a horizontal wheel.

"In order to avoid any liability of the steering-head being unintentionally moved to or fro while turning it, a locking device may be provided similar to that used for locking railway signal-levers or for the reversing-levers of engines, operated in the case of a bicycle handle-bar by means of a handle similar to that of a bicycle-brake and in the case of a horizontal wheel by a second horizontal wheel directly under the first and mounted on a sliding collar connected to the locking device, so that by raising the lower wheel the locking device is released."

No. 627,134.—Secondary Battery.—William M. McDougall. East Orange, N. J. Application filed August 4, 1898.

In the accompanying drawings, Fig. 1 is a perspective view of the non-conducting casing of the plate. Fig. 2 is a side elevation of the conducting portion of the plate before it is inserted in the case. Fig. 3 is a side elevation of the conducting portion of the plate as it appears after it has been inserted in the case and given its final shape. Fig. 4 shows a sectional view of the non-conducting casing, taken on lines x x of Fig. 1. Fig. 5 is a section on line y y of Fig. 1. Fig. 6 is a sectional view of the plate completed with the active material in place.

Referring to the drawings by letter, a represents a non-conducting casing, made, preferably by the molding process in a single piece, of a composition of rubber and some baser substance. The case is provided with a series of uniformly-disposed perforations a1, preferably rectangular and arranged in horizontal and vertical rows. The horizontal webs a2 between the rows of perforations are perforated centrally, as shown at a3, and the top and bottom cross-bars are also sim-



ilarly perforated, thus providing straight passages through the interior of the plate from top to bottom. The top bar of the case is provided with a groove *a4*, into which these vertical passages lead, and the corners of the plate will have lugs *a5* formed upon them, through which binding-rods may pass to secure the different plates of a cell together.

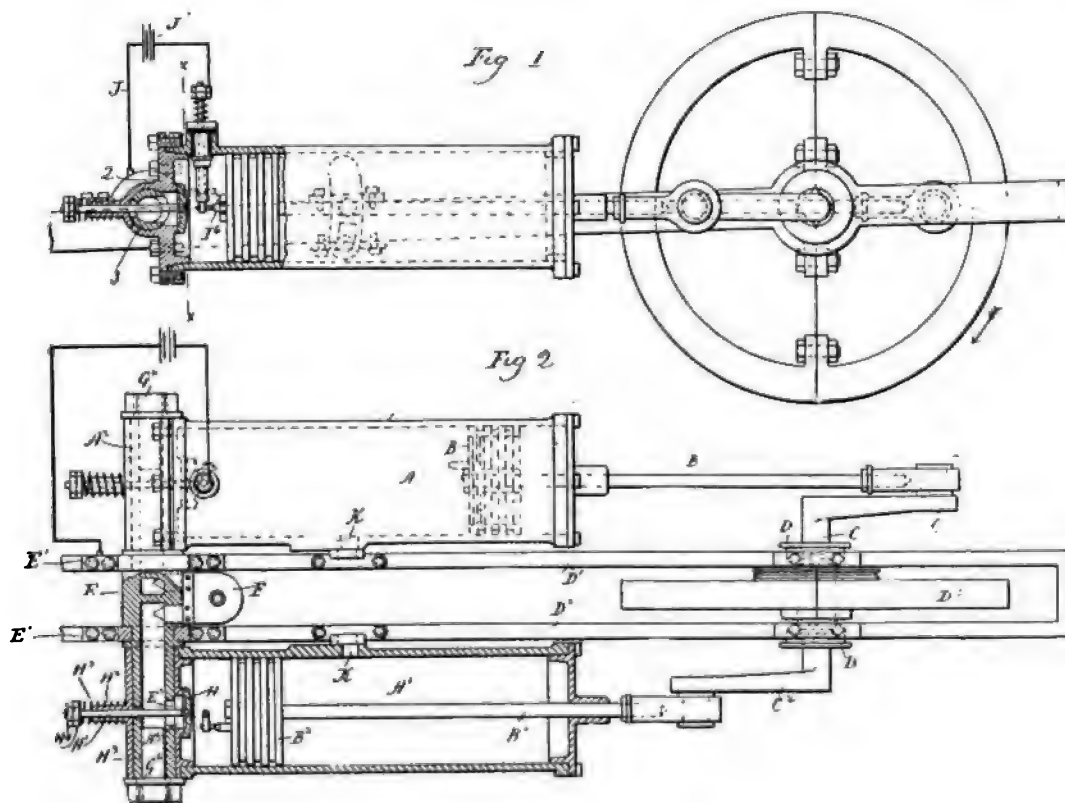
The conducting portion of the plate consists of a grid *b*, of lead, formed by a cross-bar *b1* and thin bars of wires *b2*,

projecting at right angles therefrom. The cross-bar also carries a lug *b3*, through which electrical connection with the plate may be effected. This conducting portion of the plate is applied to the casing by passing the bars or wires *b2* through the perforations which lead into the groove *a5* of the case, the wires being thus forced to pass through all of the rectangular spaces *a1* in the case, the cross-bar *b1* finally resting in the groove *a5*, in which it is sealed or covered by asphaltum or similar non-conducting material to protect it from the solution of the cell. When the case and conducting portion of the plate have been thus placed together, those portions of the wires *b2* which are exposed in the openings *a1* are flattened out or enlarged, as shown in Fig. 3, by means of any suitable die or tool. This not only prevents the metallic portion of the plate from moving within the other portion, but also increases the surface of the metallic portion. The plate thus constructed is ready for the active material, which is then filled into the openings *a1* and pressed into intimate contact with the lead surfaces contained therein. The portions of the active material inserted from opposite sides will become knitted together around the lead portions and will thus firmly become anchored in the plate.

The invention is not limited to the making of the non-conducting case by a molding process, as it may be made in two parts, which after the conducting-grid has been placed between them may be sealed together by the application of heat and pressure.

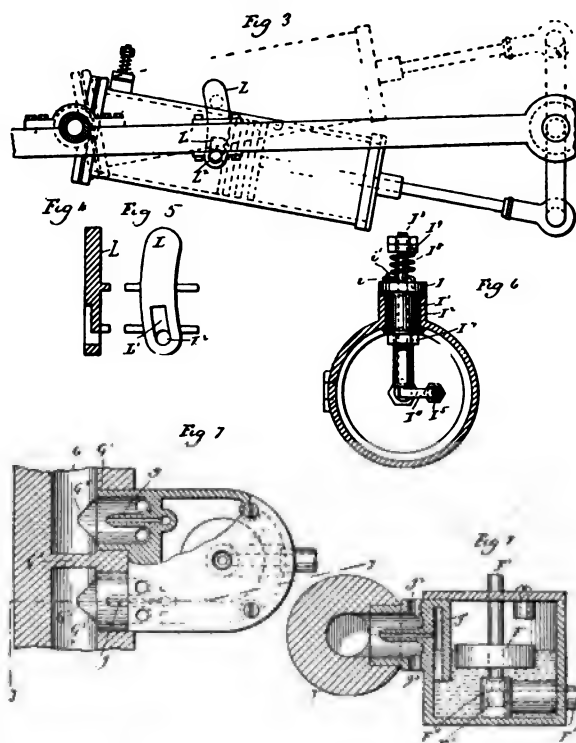
No. 627,857.—Gas Engine—Harry A. Knox, Springfield, Mass., assignor of four-fifths to the Overman Wheel Co., of Hartford, Conn., and Chicopee Falls, Mass. Application filed July 13, 1897.

This invention consists in an expansive gas engine having a cylinder furnished with an exhaust port located about midway of its length and a valve arranged to coact with the said port and close the same during the forward stroke of the



piston and open the same for the exhaustion of one-half of the combustion products during the first half of the back stroke of the piston.

The cylinder A is provided with a piston B, secured to the inner end of a piston rod B₁, the outer end of which is connected with the crank arm C of the shaft C₁, which is also furnished with a corresponding oppositely extending crank arm C₂, to which is connected the piston rod B₂ of the piston B₃ of the cylinder A₁. The said shaft C₁ is mounted in ball bearings D D, attached to the long frame pieces D₁ D₂ of the machine frame. H heavy fly-wheel D₃, located between the said frame pieces, is secured to the shaft C₁ and by its inertia carries the engine by its dead points. The two cylinders are arranged to have limited oscillating movements in parallel vertical planes upon a long horizontally arranged trunnion E, which is mounted in the said frame pieces D₁ and D₂, to which it is secured by caps E₁ E₁, the cylinders being connected with the respective ends of the said trunnion by means of their heads A₂ and A₃, the outer faces of which are formed with chambered extensions for the reception of the ends of the trunnion. A mixture of gas and air is supplied to the engines from an atomizer located between the frame pieces D₁ and D₂ of the machine frame and at a point closely adjacent to the inner face, so to speak, of the trunnion E.



The said atomizer may, of course, be of any suitable construction and adapted to use any form of fuel, such as gasoline, and to mix it in any desired proportions with a given quantity of air. As herein shown, the atomizer consists of a tank F, containing a float F₁, secured to a vertically movable shaft F₂, the lower end of which is furnished with a valve F₃ and plays up and down in a valve box F₄, so as to control the inlet of liquid fuel into the tank through the supply pipe F₅, which intersects the valve box F₄ and the central longitudinal passage of which is opened or closed, according to the position of the float, by the valve F₃. When the float falls, the valve

opens the passage in the pipe F₅ sufficiently to allow the liquid fuel to flow into the tank, the inflow of liquid being then cut out by the lifting of the valve under the action of the float. The said tank is formed with two corresponding mixing chambers G and G₁, located within stems or projections which pass through apertures G₂ G₂, formed to receive them in the trunnion on opposite sides of the transverse web G₃, which divides the central longitudinal bore or passage of the trunnion into the chambers G₄ and G₅, the outer ends of which are closed by plugs G₆ G₆. The said mixing chambers G and G₁ are provided with centrally arranged nozzles g g, the inner ends of the longitudinal passages of which intersect vertical passages g₁ g₁, the lower ends of which extend below the surface of the liquid fuel in the tank. The rear end of each mixing chamber is provided with a pair of upper and a pair of lower air inlet ports g₂, which are located opposite the bases of inner ends of the nozzles g g. When in the operation of the engine a vacuum is produced in the chambers G₄ G₅ of the trunnion, the pressure of the atmosphere upon the liquid fuel will cause the same to be ejected from the nozzles g g and at the moment of its ejection therefrom be commingled with air, which will rush in to fill the vacuum through the air inlet parts g₂. An explosive mixture is thus formed for the charging of the respective cylinders. I may here say, however, that I do not limit myself to the use of any particular form of atomizer nor to any particular way of introducing charges of explosive vapor into my improved engine. The explosive vapor, having been admitted into the inner ends of the passages G₄ G₅, flows thence outwardly and passes through transverse ports E₂ E₂, formed in the ends of the trunnions, into ports A₄, formed in the cylinder heads A₃, the ports A₄ being closed by inwardly opening valves H, secured to the projecting inner ends of valve stems H₁, the outer ends of which have bearing in hollow stems H₂, formed integral with the respective heads and encircled by springs H₃, the outer ends of which impinge against nuts H₄, applied to the ends of the valve stems. Each cylinder is also provided upon the upper face of its inner end with an igniter comprising a box I, inclosed in a packing I₁, mounted in the said box I, projects above and below the same, its lower end being furnished with an offsetting rod I₄, carrying the contact point I₅, which coacts with a corresponding contact point I₆, mounted in the piston head. The inner end of the box I is reduced for the application to it of a nut I₇, by means of which the box is clamped in place. The projecting upper end of the rod is furnished with a spring I₈, the upper end of which is connected with a nut I₉, mounted upon the extreme upper end of the rod, while its lower end is fixed in the top of the said box I. Against the tension of this spring the rod is rotated on its longitudinal axis within the limits afforded by a stop-pin i, which plays in a staple i₁. The said pin and staple may, of course, be replaced by a variety of devices for the purpose of limiting the rotary movement of the igniter rod, which is located in an electric circuit J, containing a battery J₁. Before the piston of either cylinder reaches the limit of its exhaust stroke or mistroke its contact point I₆ engages with the contact point I₅ of the igniter and swings the igniter outward against the tension of its spring I₈, which on the other hand causes the rod to be oppositely turned and the contact point I₅ to follow the contact point I₆ without breaking contact until after the piston has begun its outstroke and until after its crank has passed the dead center, when the contacts separate with the effect of producing the spark which explodes the charge.

By deferring the production of the spark and the ignition of the explosive until after the piston has begun its outstroke the inventor claims to avoid that shock to and strain of the working parts of the engine due to producing the spark and igniting the explosive mixture before the piston has completed its instroke, which must then be completed against the force of the power is lost. The fact that by deferring the ignition of the explosive mixture until after the piston has begun its outstroke cuts something off from the effective length of that stroke is said to be immaterial for the reason that the cylinder is so long that ample opportunity is given for the complete ignition and expansion of the entire charge of explosive mixture. Each cylinder is also furnished at a point about midway of its length with an exhaust port K, the location and operation of which is the most important feature of my present invention. These ports are alternately opened and closed by the sliding contact of the cylinders as they vertically oscillate with segmental valves L, secured to the outer faces of the frame pieces D1 and D2 of the machine frame. Each of the said valves has a segmental recess L1, intersecting at its lower end a port L2, opening outward into the atmosphere. The exhaust ports K before mentioned are formed in large flat bosses formed upon the inner faces of the cylinders and constituting valve seats for sliding coaction with the valves L.

The inventor prefers to employ cylinders relatively long in proportion to their diameter and made of a metal of high heat conductivity and such great tensile strength as to enable them to have very thin walls. By making the cylinders long in proportion to their diameter the maximum of expansive force of the heated gas is secured. Furthermore, by making the cylinders relatively long and of a metal of high heat conductivity the heat of the gas is so rapidly taken up and radiated that the temperatures of the cylinders may be kept within proper limits without the assistance of a cold water jacket or of other means for the purpose, whereby the double advantage to a high temperature that is most favorable to a high efficiency and of dispensing with the use of water for keeping the temperature down. The use of a cooling jacket adds weight to the engine and is peculiarly objectionable on account of the difficulty of carrying water when the engine is to be used for the propulsion of vehicles such as horseless carriages.

The combustion products are not exhausted or ejected all at one time, as has been universally done heretofore, but fractionally or by piecemeal. As herein shown, half of the combustion products are ejected at one time and half at another time. To assist in the fractional ejection of the combustion products the pressure of the incoming explosive mixture is utilized for pushing the last half or remnant of combustion products from the inner end of the cylinder to the outer end thereof and into position for their ejection.

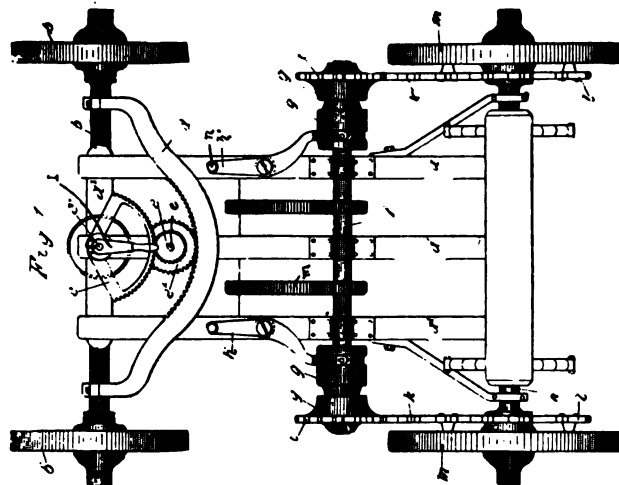
No. 627,503.—Motor Vehicle—John D. Humphrey, New Britain, Conn., assignor of one-half Frank H. Afford and John E. Curran, same place, and James I. Curran, Holyoke, Mass. Application filed February 9, 1899.

In the accompanying drawings the letters a, a1, a2, and a3 denote parts of the "vehicle frame."

The letter b denotes the forward axle, a swinging axle bearing wheels b1 for guiding the vehicle in its travel.

The letter c denotes a gear segment fast to a shaft c1, stepped in a pillow block c11, mounted on the frame directly above the king-bolt of the axle b.

The letter d denotes another gear segment carried by a long yoke passing laterally over the frame and turned down-



ward and forward at its ends, which are made fast to the axle b.

The letter e denotes a vertical idle shaft properly supported from the vehicle frame, carrying a gear e1, which meshes into the gear segment c, and another gear e2, which meshes into the gear segment d. There is an operating handle H on the upper end of the shaft c, by the manipulation of which the operator can swing the axle b as he chooses and guide the travel of the vehicle accordingly.

The letter f denotes a rotary countershaft driven by gears m from and by the motor M, not particularly described herein. On each end of it is a clutch mechanism each composed of the clutch parts g and g1, the former of which has a short longitudinally sliding motion on the shaft f and is provided with a cone adapted to co-operate with a conical socket in the clutch part g1. It will be understood that when this cone and cone-socket are brought into firm contact the rotary motion of the part g1 is communicated to the part g, but that when they are separated this rotary motion fails to be thus communicated. It is a matter of course that while the clutch parts g have the before mentioned sliding motion on the shaft f, they at the same time must rotate therewith.

The letter h denotes the handle to each of two levers h1, pivoted on the frame and which control the said meshing and intermeshing motions of the clutch parts g.

Each clutch part g is practically integral with a sprocket wheel i, from which the sprocket chains k communicate rotary motion to the sprocket wheels l. The latter are clipped and fixed to the sides of the traction wheels m, which are loose on the fixed axle n, duly attached to the vehicle frame.

The use of the conical intermeshing surfaces of the clutch mechanisms prevents that sudden starting of the parts in rotation which is liable to break them. Moreover, when the operator desires to leave the vehicle in safety, as for the night, he has but to unship the shaft c1 and segment c and carry them with him, and in their absence no unauthorized person can steer the vehicle. Again the use of this segment with the large and small gears e2 and e1 necessitates only a small movement of the handle H to swing the front shaft to a considerable degree.

No. 627,842.—Motor Vehicle—Gustave Victor Leon, Chauveau, Paris, France, assignor to La Société Anonyme des Voitures Automobiles, same place. Application filed June 23, 1898.

The present invention has for its object improvements in automotive tricycles of the type intermediate in size between a velocipede and a full-sized road carriage, such as the auto-tricycle, the invention of Leon Bollee, patented in the United States of America, March 29, 1898, No. 601,545, these improvements of removable seats and parcel carriers to be mounted at the front of the Bollee tricycle.

AUSTRALIAN PATENTS.

From Phillips, Ormonde & Co., patent and trade mark agents, 533 Collins street, Melbourne, Victoria, who are in possession of further information if wanted.

Driving Gear.—J. W. Brereton, of Ladywell Athone, West Meath, Ireland. 5th January, 1899. No. 15,829. In the Colony of Victoria.

Steam Motor.—W. Bailey, Sandgate Road, Albion, Brisbane, Queensland. 3d September, 1898. No. 4,795. In the Colony of Queensland.

Motive Engines.—A. Howard, R. N., of 1025 Pine street, San Francisco, California, U. S. A. 20th December, 1898. No. 11,225. In the Colony of New Zealand.

Induction Valves for Motive Engines and Gearing to Actuate the Same.—A. Howard, R. N., of 1025 Pine street, San Francisco, California, U. S. A. 20th December, 1898. No. 11,225. In the Colony of New Zealand.

Motor.—A. Anderson and O. Magnus, both of 2 Commercial Chambers, Manse street, Dunedin, New Zealand. 22d April, 1898. No. 10,528. In the Colony of New Zealand.

A New Motor.—A. A. Newnham Howes and R. G. Applegarth, both of Wellington, New Zealand. 27th February, 1899. No. 11,406. In the Colony of New Zealand.

Automotor Carriage or Vehicle.—W. J. Brewer, 15 Denbigh Place, Belgrave Road, Pimlico, London, England, and J. E. Cooper, of 1 Gladstone Villas, Prince's avenue, Withernsea, in the County of York, London, England. 24th November, 1898. No. 2,309. In the Colony of Western Australia.

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English Motor Vehicle Show at Richmond, page 7.

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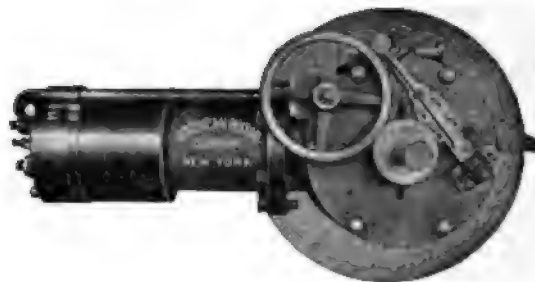
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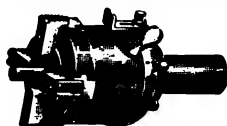
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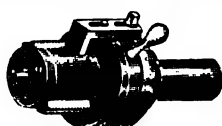
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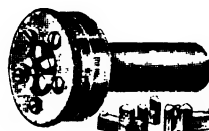
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VOL. IV.

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communications on trade topics from any authentic
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be given as an evidence of good faith, but will not be
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THE HORSELESS AGE, 150 Nassau Street, New York.

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On account of the excessive discounts charged
by New York banks on small checks under their
new rule, subscribers are requested to remit by
Post Office or Express money order or N. Y. draft.

Chicago Wants Motor Drivers Licensed.

The city electrician and Mayor of Chicago, who are leading the opposition to the motor vehicle in that city, have drawn up a letter embodying the reasons for their action, and giving in brief a synopsis of the terms which, in their opinion, should be included in the bill which the corporation counsel is preparing.

The reasons which they assign for their attitude toward the new vehicle show that they are laboring under the same misconception of the subject that is prompting the introduction into the New York Assembly of a similar bill requiring that none but skilled electricians shall operate electric vehicles. The fundamental error here is a failure to see that the construction or regulation of a machine and its ordinary operation are two separate and distinct functions. Clocks and watches are running in every household, but when they get out of order they are taken to the watchmaker for repair. In

the thousands of factories scattered throughout the length and breadth of the land are hundreds of thousands of operatives tending machines requiring various degrees of skill. These operatives could not construct the machines they tend, nor could they repair them; yet in the manipulations necessary for the rapid and accurate performance of work the operatives are more expert than the designers and mechanical engineers who build and repair them. In other words, the operation of machinery that reaches the stage of perfection termed industrial or commercial, falls necessarily into non-expert hands. Competition compels this, for if labor of too high grade is needed for the operation of a new machine it cannot compete with the older and more familiar processes which it is intended to displace. This truth is so obvious in all branches of manufacture that further discussion is unnecessary. It is equally true of the driving of trolley cars and motor vehicles, the operators of both classes of machines being persons who must be considered as mechanically non-expert.

The qualifications for a successful driver of a motor vehicle are the same as those found in a good cabman or stage driver. It is of course desirable that the motor vehicle driver should have a superficial knowledge of his vehicle so that he may get the most out of it in service and not be utterly helpless in case of accident, but the technical knowledge of the engineer is not required of him. So much for the first reason.

The second is also founded in error, for it is evidently based on the assumption that the percentage of accidents caused by motor vehicles is greater than that caused by horse vehicles. The official letter says vaguely that "accidents have happened through careless or incompetent drivers of motor vehicles." This is a statement which no one can deny, and which will stand as undeniably true to the end of time, but it is incumbent upon the authors of this bill to prove that motor vehicles are extra hazardous and that the control of them is more difficult than the control of a horse. Unfortunately

public officials will not take the time to enlighten themselves on these important points and thus be able to legislate intelligently, but, influenced solely by prejudice, they plant themselves stolidly in the path of progress. The relative manageability of the motor vehicle and the horse can easily be determined by investigation and experience, and can be decided in one way only—overwhelmingly in favor of the motor. So far as the carelessness and incompetence of motor drivers is concerned let the city electrician and the Mayor of Chicago look the facts squarely in the face and they will see boys of fourteen to sixteen years and drunken men in charge of horses in all our large cities, driving with loose reins and at unlawful speeds; they will see horses in constant use that are habitual runaways, liable at any moment to dash wildly through the streets, carrying death and destruction with them. Then, if they will visit the motor vehicle companies and learn the character of their drivers and the wages paid, and get further light by riding in motor vehicles for a few days, they will surely be convinced of their mistaken zeal and lay this bill on the table indefinitely.

The fact that the motor vehicle industry is new and promises such phenomenal development attracts to it a higher class of labor and disposes employers to be more careful in the selection of their men.

Among the recommendations offered by the Chicago officials the only one of any practical value is that limiting the speed of motor vehicles in the city streets to 8 miles an hour. It could be wished that this limit might be raised to 10 miles an hour because of the superior control of the motor vehicle, but that some such speed limit is needed is generally conceded by the reasonable element in the motor vehicle industry.

The English Automobile Club's Show.

We print in this issue, from our special correspondent, a very complete account of the exhibits at the Richmond Automobile Show, held by the Automobile Club of Great Britain last month. From the copious illustrations published, a very fair idea may be gained of the many different types of vehicles now on the market in Great Britain, and a realization of our own inexcusable backwardness in putting the new vehicle on a manufacturing basis in the United States. It was not until November, 1896, that the Red Flag Law was abolished in England and it became lawful to use motor vehicles upon the public highways, yet in less than three years a very noticeable progress has been made, notwithstanding the retarding effect of the speculative operations of the British Motor Syndicate.

If we search for a reason for our own deficiencies in the motor industry we shall not need to look further than the inventors and promoters whose absurd claims and wildcat schemes have travestied the industry and kept capital and sound business ability aloof from it.

Happily the influence of the boomers is on the wane and sober sense and legitimate enterprise are beginning to prevail. We shall not long be at the end of the procession. Men of cool judgment and good policy who have been holding back, hesitating to identify themselves with the new industry, should take confidence and cast in their lots at once. The time is opportune. A considerable fund of knowledge and experience is obtainable to serve as a guide and enable the manufacturer to avoid a repetition of others' experimental mistakes, and the motor vehicle is admittedly needed in all branches of the world's work.

Dangers of Tube Ignition.

An accident which occurred to a gasoline motor carriage the other day near Manchester, England, exemplifies well the danger of the tube ignition. The carriage, containing a driver and two ladies, was descending a steep hill, when some part of the steering gear broke and the vehicle was suddenly overturned, pinning the occupants underneath while the gasoline leaked on to the burners and so carried the fire to the helpless prisoners beneath.

Timely assistance prevented fatalities but the driver was very severely burned.

The recent discussion which has recently taken place in England over the respective merits of tube and electric ignition for vehicle motors should be easily answered after this accident. Such a calamity would be impossible if electric ignition were used.

A New Name For It.

While the philologists are amusing themselves with the invention of new names for the motor vehicle a Western newspaper spontaneously springs upon us a name which, in length and breadth, far surpasses any the philologists have yet been able to invent. It is "horseless carriage bicycle," a medley of horses, bicycles and carriages that is not so inappropriate a description of the work of some of our inventors as might be supposed.

An ordinance requiring fenders on all motor vehicles is also to be introduced in the Chicago Board of Aldermen, and a loud protest has been raised by the local manufacturers on the ground that the fenders would prove a disfigurement.

There is no need of fenders on light pleasure carriages, but they will probably be required on motor omnibuses, that is, on heavy vehicles making relatively high speed. A weight and speed limit would then determine the necessity of fenders.

English Motor Vehicle Show at Richmond.

THE AUTOMOBILE CLUB'S EXHIBITION AT RICHMOND.
(From Our Own Correspondent.)

London, 25th June.

The leading feature of the week in English motor circles has, of course, been the Automobile Club's Exhibition at Richmond, about 12 miles out of London. The show has been held in a number of temporarily-erected marquees in the Old Deer Park, and as these are dotted here and there at some distance from one another, the exhibition has presented somewhat of a straggling appearance. The main attraction has undoubtedly been the large demonstrating track, on which, thanks to the fair weather, motor vehicles of all kinds have been careering all the week. Of exhibitors there are altogether about 57, and while many of the vehicles displayed are old friends, several new types and new designs of old ones are shown.

THE STEAM VEHICLES.

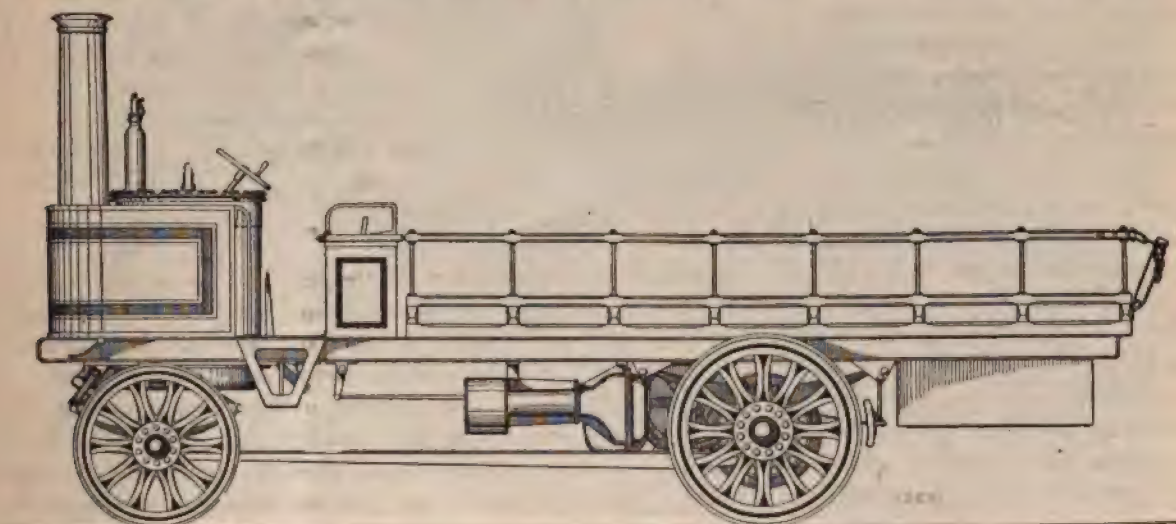
Dealing first with steam vehicles, of which an instructive display is made, the first place may be accorded to the Liquid Fuel Engineering Co., of East Cowes, Isle of Wight, who show a highly-finished steam bus, constructed for a French company for service between Hyeres and Toulon, in the south of France. The bus is arranged to accommodate 28 passengers—16 inside and 12 on top—there being also storage room on the roof for about 10 cwt. of baggage. The Liquid Fuel Co.'s system has been frequently described, so that it will suffice to say that the boiler is of the water-tube type, is oil-fired, and is located in the fore part of the vehicle. The engines are of the horizontal compound reversing type of 45 H. P. The power of the motor is transmitted to the differential counter-shaft by bevel gearing and from the latter to the rear wheels through pinions, gearing with internally-toothed rings bolted to the wheels.

The most novel steam vehicles displayed are those shown by the Clarkson & Capel Steam Car Syndicate, of Devereil St., Gt. Dover St., London, S. E., and as this concern appears to be the only one working with a view of producing a light steam carriage in England, the details will be

read with interest. Their exhibit comprises a steam lorry, a landau and a two-seated victoria. The lorry is intended to carry a load of four tons, the tare weight being 58 cwt. The boiler is oil-fired and is located in the front portion of the vehicle. It supplies steam to a 17 H. P. enclosed compound engine. The power is transmitted through chain gearing both from the motor shaft to the countershaft and from the latter to the rear axle. The water supply to the boiler is automatically controlled by Clarkson & Capel's reciprocating float gear, and renders the boiler practically independent of the driver's attention. The oil fuel is consumed on Clarkson's system, and is automatically regulated according to steam pressure. The exhaust steam is condensed by the atmosphere acting upon wire covered copper tubes fitted into the roof of the cab over the driver, under which is located a large horizontal fan, driven by a rope off the motor. This condenser does away with the necessity for carrying a large supply of water, and secures the advantage of supplying the boiler with clean distilled water that keeps the interior of the boiler free from deposit, and thus does away with the necessity for frequent cleanings. The lorry is provided with a two-speed gear, giving six miles an hour on the level and two miles uphill.

The two-seated victoria is a converted horse vehicle. The boiler is of the semi-flash type and is located at the rear. It is oil-fired and supplies steam to a 4 H. P. twin-cylinder double-acting engine. Only one speed gear is used, the power and speed being controlled by the steam throttle solely. In the front of the carriage is fixed one of the firm's air condensers, which is assisted by tubular wings over the front wheels. The fuel and reserve water tanks contain sufficient for a 50-mile run, and the pressure gauges, as well as fuel and water quantity indicators, are placed conveniently in view of the driver. Two powerful band brakes acting upon the driving wheels are operated by a foot lever. The motor transmits its power to a countershaft by a driving chain, while pinions on the end of the countershaft gear with internally-toothed rings bolted to the rear road wheels. The weight of the carriage complete is 12 cwt.

The landau is of very novel appearance, and has been designed to secure the utmost possible comfort to the passengers. The body is suspended by C-springs on an underframe that carries all the machinery. The underframe is



THREE-TON THORNYCROFT STEAM DRAY.



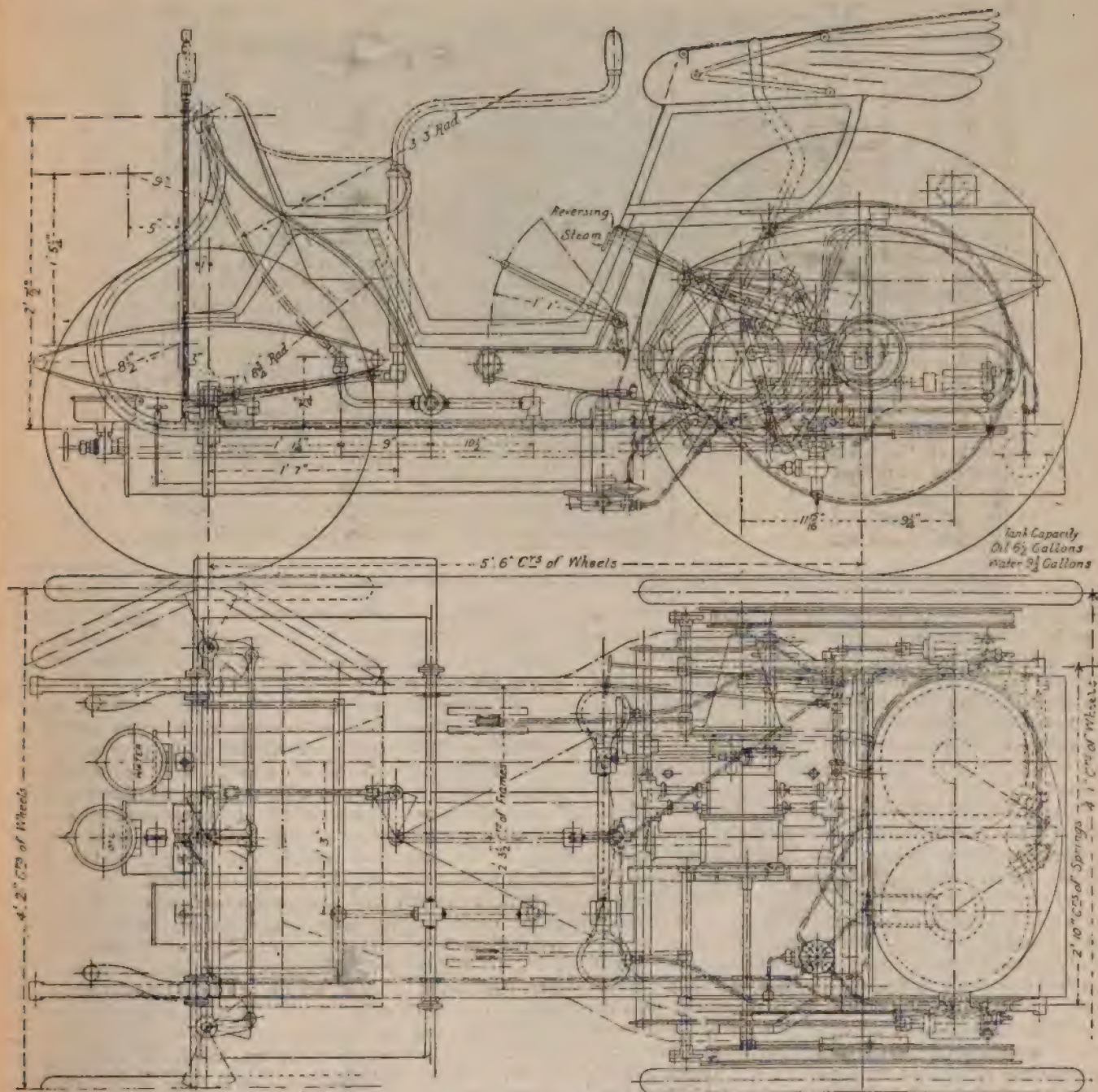
THE CLARKSON-CAPEL STEAM VICTORIA.

constructed of steel channels, bent to elliptic curves. All the propelling machinery is placed in the rear of the underframe. The position of the driver's seat is also placed behind, the driver being thus in more direct communication with the machinery, enabling the front portion of the car to be utilized for the condenser, and giving the passengers an unobstructed view. The steam generator is of a modified Thornycroft type, is oil-fired and supplies steam at 200 lbs. per square inch. It is fitted with a reciprocating float gear, which keeps the water-level constant and dispenses with glass water-gauges. The engine is of the compound enclosed self-lubri-

cating type, similar to the one on the lorry referred to before, and develops up to 17 i.h.p. The power is transmitted by chain gearing to a counter-shaft fitted with balance gear, and a two-speed friction clutch, giving 7 and 15 miles per hour, is operated by a single lever. The steam regulating valve is of a four-ported design, and enables a steam brake to be operated by a backward movement of the driving lever. There is also a foot lever actuating a pair of semi-band brakes. The steering is effected through a quadruple-threaded screw mounted upon the front axle, which locks the steering wheels in all positions, enabling the hand to be re-



THE CLARKSON-CAPEL STEAM LANDAU.



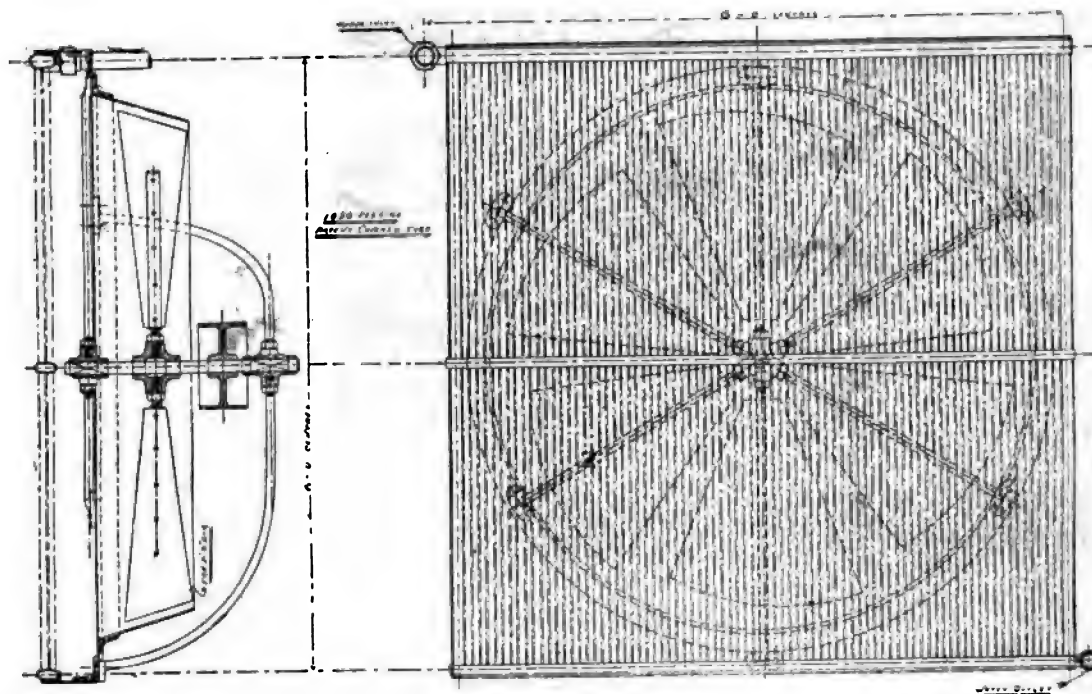
PLAN AND ELEVATION OF THE CLARKSON-CAPEL STEAM VICTORIA.

moved from the controlling wheel without any risk. The fuel and water tanks contain sufficient for a run of 100 miles. The weight of the landau in running order is about 30 cwt.

The Steam Carriage and Wagon Co., of Chiswick, S. W., showed a couple of steam wagons built on the Thornycroft system. One is a brewer's dray, built to carry a load of three tons and to haul a two-ton capacity trailing wagon; the other is a steam dray, weighing under the statute limit of three tons, intended to carry a load of three tons. The boiler, which is coal-fired and of the Thornycroft water-tube type, is located in the fore part of the vehicle. The heating surface is 65 square feet, the grate area 2 1/2 square feet,

the test pressure 350 lbs. per square inch, and the working pressure 180 lbs. The engine, which is of the horizontal compound type of 14 h.p., is entirely enclosed in a dust-tight casing, the moving parts working in an oil bath. The vehicles are entirely controlled from the driver's seat. Provision is made for the carrying of coal sufficient for a run of 50 miles, or of water sufficient for about 15 miles.

The brewers' dray is chain-driven from the counter-shaft to the rear axle, but in the lorry, which is of a later type, chains have been discarded in favor of a new chainless arrangement. The attendant in charge of the stand was not very willing to afford information, unfortunately, or to afford



THE CLARKSON-CAPEL CONDENSER. (EMPLOYED IN STEAM LORRY). ELEVATION AND SECTION THROUGH CENTRE.

your representative an opportunity for inspecting the new gear, but from a cursory inspection I gathered that the rear axle, which is a compound one, is driven by spur wheels. The rear wheels are mounted loosely on the solid axle and are driven through the medium of springs attached both to the hubs of the wheels and to the hollow axle surrounding the solid one. A two-speed gear is provided, with the low one of which it is stated that a gradient of 1 in 6 has been climbed.

Bayleys, Ltd., of Newington Causeway, Southwark, S. E., exhibit a new lorry which is a combination of parts of other vehicles, comprising a coke-fired De Dion water-tube boiler, a Straker motor, and a transmission mechanism very similar to that employed on the Daimler gasoline carriages. The vehicle is stated to weigh, unladen, 58 cwt., and to be designed to carry a load of four tons. The engine, which is of the vertical compound type, is arranged under the driver's seat and is stated to indicate 20 h.p., the normal speed being 500 revolutions per minute. The shaft of the motor extends from the front right to the rear of the car, where the power is transmitted through bevel gearing to an intermediary shaft. The latter carries at its ends small pinions, which gear with internally-toothed rings bolted to the rear road wheels. A variable speed gear is provided, and it is stated that the lorry can attain any desired speed from two to seven miles per hour.

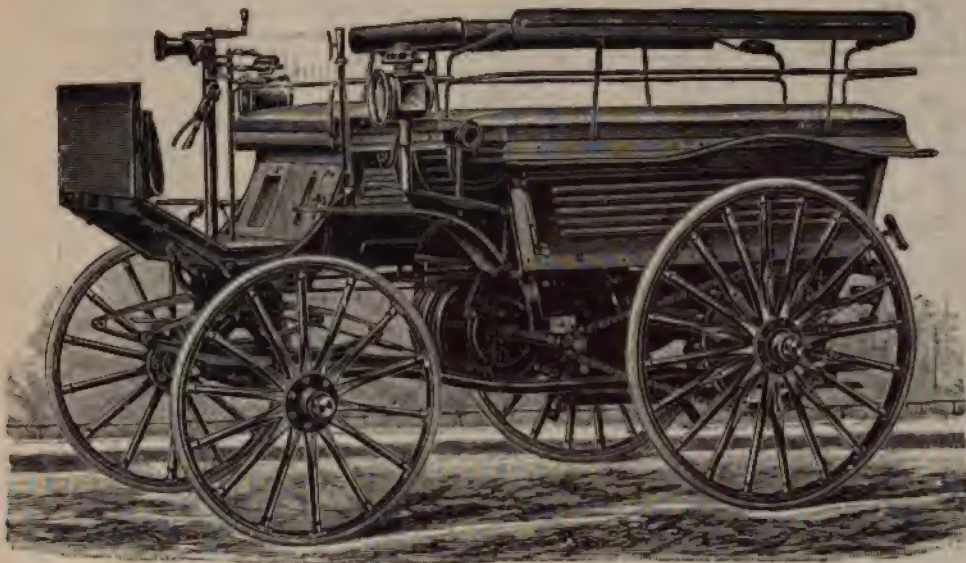
Des Vignes, Cloud & Co., of Strand-on-the-Green, Chiswick, S.W., is a new firm, making a specialty of boilers and engines for steam vehicles. Four boilers are exhibited—a 7-h.p. water-tube type, weighing 204 lbs.; an 8-h.p. semi-water tube, weighing 270 lbs.; a 7-h.p. fire-tube type, whose weight is $3\frac{1}{2}$ cwt., and another of the same type of 4 h.p. and weighing 2 cwt. Of small steam engines, a well-finished 3-inch set of the two-cylinder vertical type is shown, as well as a small and light high speed horizontal engine.

GASOLINE VEHICLES.

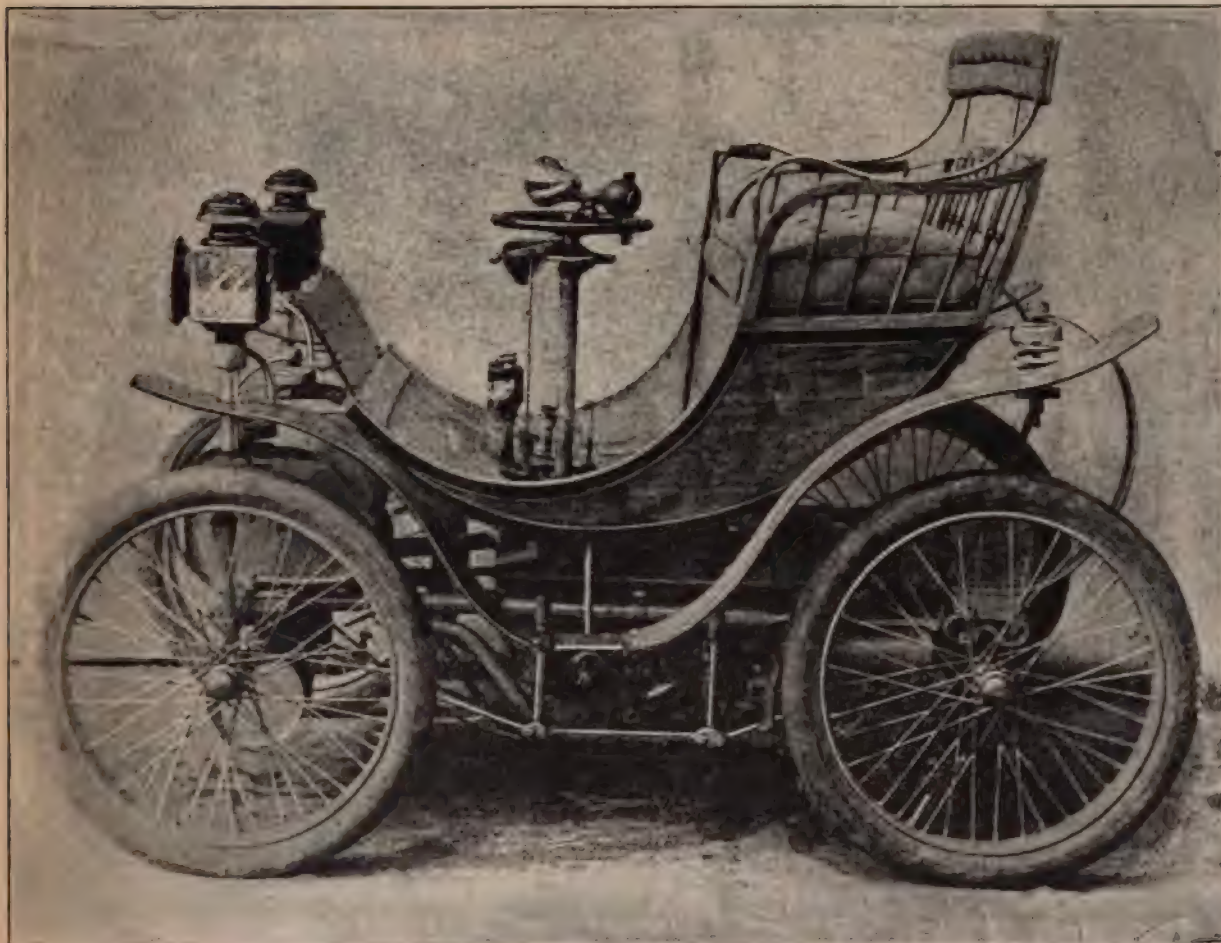
Gasoline vehicles form by far the great majority of the exhibits. A good many of these are now well known, but several are quite new.

The Daimler Motor Co., Ltd., of Coventry, have a large display of different types of vehicles, all mounted on the standard Panhard-Daimler frame, with $5\frac{1}{2}$ -h.p. motor in front. Most of the vehicles are provided with four speeds, ranging from four to sixteen miles per hour, together with a backward motion. Stronger gearing is now being fitted into the vehicles, while larger bearings generally are being employed. The Daimler Co. are also now fitting their vehicles with a water-cooling coil, by the use of which the amount of water to be carried for cooling purposes is reduced to four gallons, sufficient, the makers state, for an ordinary day's run, without it being necessary to refill the water tank. The vehicles of this Co. which have undoubtedly attracted most attention at the show, are the new light two-seated carriages. One of these is fitted with a 4-h.p. motor, and the other, with a motor capable of working up to $5\frac{1}{2}$ h.p. The latter car weighs complete only 9 cwt., and is fitted with two speeds, eight and sixteen miles per hour, a hill-climbing gear giving four miles per hour, and a reverse motion. The Daimler Co. also exhibit the two huge delivery vans recently constructed for the British Postoffice.

One of the first exhibits to attract attention on entering the exhibition is that of the Motor Mfg. Co., Ltd., of Coventry. The display is of a very varied character, comprising no less than five distinct types of vehicles. First we find motor-tricycles and quadricycles fitted with a $1\frac{3}{4}$ -h.p. English-built motor of the De Dion type. The second type is to be found in a three-seated Bollee voiturette adapted to seat two persons in the front, with the driver at the rear. Class No. 3 is to be found in the Panhard-Daimler vehicles fitted with a $5\frac{1}{2}$ -h.p. motor on a standard frame. Of these several are



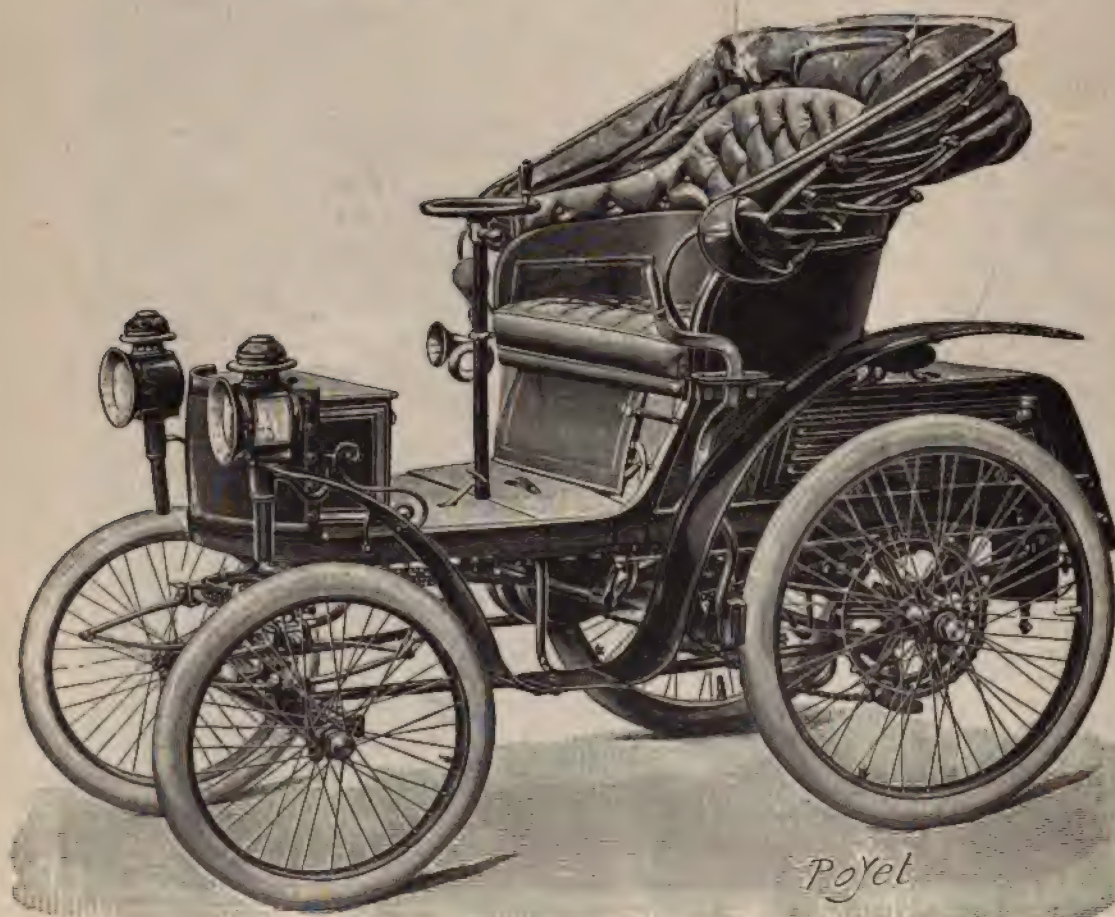
HEWETSON'S FENZ BRAKE.



THE MOTOR MFG. CO.'S NEW "PRINCESS" SOCIABLE.



THE DAIMLER CO.'S "CRITCHLEY" CARRIAGE.



THE GEORGES RICHARD "DUKE" GASOLINE CARRIAGE.

shown, ranging from a neat four-seated dog-cart to a nine-seated charr-a-banc of the kind now being employed for public service in various parts of the United Kingdom. In this class must also be included two motor parcels vans capable of carrying loads up to close upon one ton. Type No. 4 is to be found in the Sandringham phaeton. This is a four-seated vehicle of the type introduced toward the end of last year. It is fitted with a 6-h.p. Iden horizontal motor, four forward speeds and one reverse motion being available. The principal novelty at this stand is, however, the Princess two-seated sociable car in which the motor is of the two-cylinder horizontal type of $4\frac{1}{4}$ -h.p., with tube ignition and water-jacket. The power is transmitted from the motor shaft to the counter shaft by spur wheels and from the latter to the rear road-wheel axle by a central single chain drive. Three forward speeds and two reverse motions are provided, while a special feature is the provision of a governing device by means of which when the car is at rest the motor may be kept in motion, but slowed down to the extent of but one explosion per minute. The vehicle, which weighs complete only $8\frac{1}{4}$ cwt., is provided with a detachable dashboard, in place of which a small additional front seat can quickly be fitted.

The exhibit of Stirling's Motor Carriages, Ltd., Hamilton, N. B., is deserving of the highest praise as showing what



GOBRON-BRILLIE CARRIAGE.

high-class carriage builder's work can be applied to motor vehicles. The company show five vehicles, all of the standard Panhard-Daimler type; the motor of $5\frac{1}{2}$ -b.h.p. and the transmission gear all being mounted on a distinct frame.

Another section of the Stirling exhibit which has come in for a large amount of attention is the Stirling-Pennington carriage, two of these vehicles—a Victoria de luxe, and a neat design of four-seated vehicle—are shown. The Pennington motor is mounted under the floor of the vehicle, the fly-wheel being fixed horizontally. Some alteration in the driving gear appears to have been made since the writer last inspected a Pennington car—the motor driving a horizontal pulley at the rear by means of a light cycle chain, the pulley being now connected to the front wheel axle by a belt in place of a rope as formerly. Another feature is that no carburettor is employed in connection with the motor, the oil being fed directly into the explosion chamber, passing on its way through the exhaust silencer and so receiving a preliminary heating. Attention is also drawn to the small amount of cooling water required. Altogether the Pennington car is built on novel lines and although a good deal of scepticism is still being shown in regard to it, it is well worthy of close inspection. The scepticism referred to has no doubt been largely due to the air of mystery surrounding

the carriage, the makers not being willing to impart any information as to the motor and its capacity, etc. One feature of the carriage which struck us most unfavorably is the chain connecting the motor with the intermediate pulley. The drive is a very long one and is done by a light chain of the cycle type, working on horizontally-fixed sprockets. It is difficult to see how this chain can work properly as soon as it has "stretched," the only thing apparent being that it will simply drop off the sprockets.

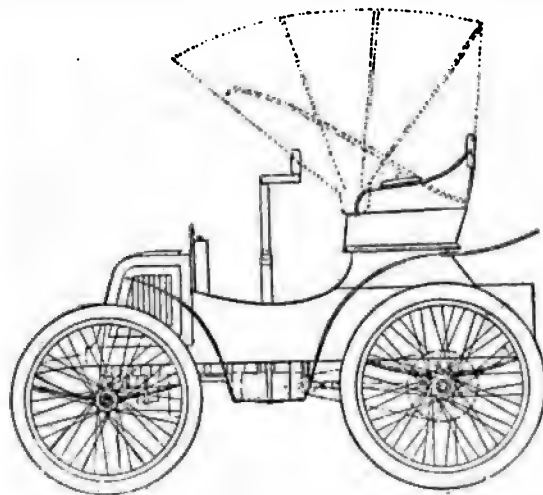
The largest stand in the show is undoubtedly that of the Automobile Association, Ltd., of Notting Hill, S. W. The brief epitome of this company's exhibits in the catalogue alone occupies nine pages, so that the variety of the display will be at once apparent. Fully a dozen different types of German and French motor carriages are shown in addition to a number of motor tricycles. A novelty in the latter class is a Barriere arranged for two riders side by side. The leading novelty—in fact the vehicle only arrived from France after the exhibition opened—is the "Silent" car, made by Gobron & Brillie, of Paris. It is claimed that these are the first carriages driven by a petroleum motor which are absolutely free from vibration. The frame of these vehicles is built up of tubes, and the body attached through the medium of rubber springs, in addition to the ordinary plate springs. In the motor there are two vertical cylinders; each cylinder has two pistons, the explosion taking place between each pair. The two lower pistons are connected by the rods to the cranks in the usual way; the connecting rods of the two upper pistons are bolted to the crosshead, at the extremities of which are the two double connecting rods, which work on the cranks, fixed 180 degrees from the others. There are thus in this motor four pistons, and in effect four cylinders, four cranks, and four connecting rods. Notwithstanding this large number of moving parts the motor is stated to run remarkably smoothly, this being due to the great care that has been taken in the design so as to secure absolute balance as far as possible, there being an impulse to the motor shaft every revolution. The admission and exhaust are operated in the usual way, but a special device is used to graduate the admission of oil to the carburator. The cylinders are water-jacketed, and the water circulated by means of a small plunger pump. The hot water passes through a radiator coil in the front of the car. The water tank holds about four gallons. As regards the gearing there are three forward and one astern speeds. The highest speed is about 20 miles. These vehicles are good hill climbers.

The motor, which is of 6 h.p., runs normally at 700 revolutions. The transmission is effected by gear wheels, there being two intermediary shafts, a friction clutch being arranged on the fast one, the connection between the second intermediary and the rear road-wheels being effected by chain gearing. The carriage, which is very elaborately and comfortably finished, takes the form of a five-seated wagonette. The Gobron & Brillie carriage comprises so many novel features as regards both the motor and the transmission gear that I propose later on to refer to it again at greater length.

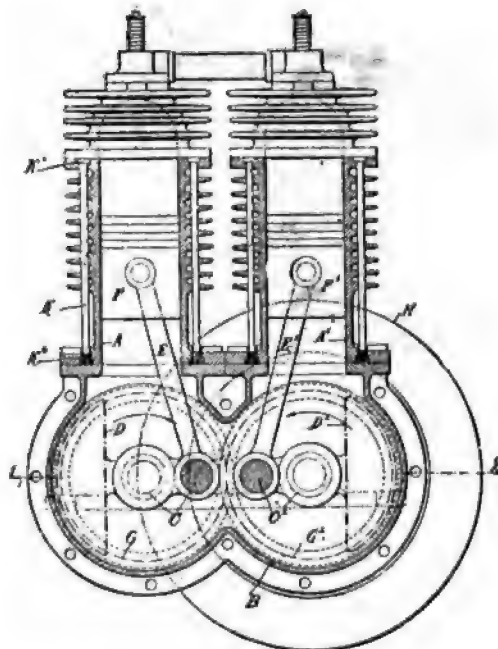
The popular little Benz motor-carriages are kept well to the front by Hewetsons, Ltd., of Dean street, Oxford street, London, W., who have about a dozen of different types on view. It is difficult to say much that is not already known of these cars. It may be mentioned, however, that the 1899 type of "Ideal" two-seated car is fitted with three forward speeds, including a hill-climbing gear, by means of which it is claimed the vehicle can mount gradients of 1 in 4. The

various details of the car have also been modified and strengthened as experience has shown to be necessary. Hewetsons have also on view a large Benz brake capable of accommodating six persons. The mechanism of this is on the same lines as the other Benz vehicles, the countershaft being belt-driven, with three forward speeds and one backward. The motor of this vehicle is a double-cylinder one, capable of working up to 8 h.p. The weight of the carriage complete is about 21 cwt.

The exhibit of the International Motor-Car Co., of 15 High Road, Kilburn, includes a number of their well-known little International carriages, built on Benz lines, but now fitted with petroleum motors of $4\frac{1}{2}$ h.p., of English make, and a "crypto" gear, which enables them to mount the steepest hills. This company have also recently adapted these cars to seat three persons by arranging an additional seat in place of the ordinary dashboard; the seat is so fitted that it can readily be removed and the dashboard re-attached when de-



—THE "ELAN" PETROLEUM-SPIRIT MOTOR CARRIAGE.



SECTION OF ELAN MOTOR.

sired. A carriage on the stand which has attracted considerable attention is a five-seated Parisian Victoria, built in Paris to the order of Baron de Zuylen de Nyevelt. The carriage is fitted with a two-cylinder Benz motor, capable of working up to 9 h.p. The transmission gear is also of the Benz type, three forward speeds and two reverse being provided. Another vehicle which is claimed to be suitable for public service is a French brake, on the Benz system, capable of accommodating 14 passengers. The motor is of the two-cylinder petroleum type of 12 h.p. The transmission is effected by means of belts; three forward speeds, including a hill-climbing gear, being provided. The cylinders are water-jacketed, a double water tank, a circulating pump, and a water-cooling coil being provided. The wheels are fitted with rubber tires, while brakes of the Lehut type are arranged to act on the hubs of the rear wheels.

Heavy oil in contradistinction to gasoline forms the feature of the vehicles shown by Roots & Venable, of 100 Westminster Bridge Road, London, S.E. One of the vehicles is a light carriage designed to carry two persons at a maximum speed of 12 miles per hour on the level, with a slower speed for inclines. It is driven by a Roots' single-cylinder motor of 3 i.h.p., using ordinary kerosene oil. There are two friction clutches, giving speeds of 4 and 12 miles per hour respectively, but any speed between one mile and the maximum can be obtained. Two independent brakes are provided. The cylinder is water-jacketed, the storage tanks having a sufficient capacity for oil and water for a journey of about five hours. The countershaft is chain-driven, while the connection between the countershaft and the rear axle is also by chain gearing. A feature is the water condensing coil, which consists of a series of copper tubes fitted round the fly-wheel in such a way that the latter works within the coil. Roots & Venable are also showing their light commercial van, designed to carry a load of about one ton. It is fitted with a $6\frac{1}{2}$ -h.p. motor. The consumption of oil for an average run of 50 miles is about 5 i-3 pints per hour; the cost of a 50-mile run being about 40 cents. In this vehicle two clutch-speeds forward, the one of 3 miles and the other of 10 miles per hour, and one clutch-speed backward of 3 miles per hour, are provided; but as in other vehicles of this firm's manufacture, the van can be driven at any speed, by graduating the friction clutches, between 1 and 6 miles an hour.

The only novelty at the stand of Friswell, Ltd., of Holborn Viaduct, London, E. C., is the "Elan" two-seated gasoline carriage, seen for the first time in England. The motor, which is located in the fore part of the frame, is of the vertical type; it comprises two cylinders, with electrical ignition, and is capable of working up to 3 h.p. For cooling purposes, radial ribs are relied upon, aided by a small fan driven off the motor, which is located in the front portion of the carriage. As regards the transmission gear, in line with the motor-shaft, and connected with it by a friction-clutch working inside the fly-wheel, is a variable speed gear shaft, suitably enclosed. Four forward speeds—6, 12, 24 and 35 kilometres an hour—and one backward are provided, all controlled by a single lever within convenient reach of the driver. From the variable speed shaft power is transmitted through bevel wheels to the differential shaft, and from the latter to the rear wheels through the usual sprocket wheels and chains. Three brakes are provided.

A gasoline carriage at the exhibition which comprises probably more novel points than any other is that exhibited

by F. W. Lanchester, of 59 Lincoln's Inn, Corporation street, Birmingham. I am only able to give a few particulars of the carriage which takes the form of a two-seated phaeton, as the whole of the motor and transmission gear is completely boxed in, and therefore not open for inspection; Mr. Lanchester, too, not being very communicative regarding the details. I was, however, able to glean from him a few of the leading details. A striking feature of the car is that, notwithstanding the small seating capacity, the motor is capable of working up to 8 h.p. The motor, which is arranged at about the centre of the frame, under the seat, comprises two horizontal cylinders, 5-in. diam. by 5-in. stroke, facing each other in the same line. Two connecting rods are attached to each piston. There are two cranks independent of each other, and two fly-wheels also independent of each other but keyed respectively to the two crank shafts, one of which is 3 in. above the centre line of the engine, the other 3 in. below it. One connecting rod from each piston goes to the upper crank pin and one to the lower, a kind of diamond-shaped linkage when the pistons are at mid stroke being thus formed. It may also be stated that the two crank shafts revolve in opposite directions, while to counteract any vibration balance-weights are attached to the connections of the crank webs. Another feature of the motor is that no water-jacket is employed for cooling purposes, this being replaced by an air-jacket, the details of which have not been made known. The ignition is electric, an ingenious magneto-electric device being employed, the rim of the fly-wheel being utilized to carry or form a permanent magnet, which, in revolving, produces an electrical current in a small armature geared near it. A hit-and-miss governor is fitted to the motor, and by means of small levers within convenient reach of the driver's hand the rate of sparking can be advanced or retarded as desired.

Another new carriage to English automobilists, although it has been on the market for some time in France, where it is built, is the Delahaye, exhibited by the Delahaye Motor-Car Co., of Donington House, Norfolk street, London, W.C. The vehicle is a four-seated phaeton, a detachable seat being also provided so that it may accommodate five persons. The motor, a two-cylinder one of 8-h.p., is of the horizontal petroleum type, with water-jacket and electric ignition. The transmission of the power is effected by means of belts to an intermediate shaft, three forward speeds and one astern being provided. A hill-climbing gear is also fitted, by means of which gradients of 1 in 6 can, it is claimed, be mounted. From the intermediate shaft to the rear axle the power is transmitted by the usual driving wheels and sprocket chains. The cylinder-cooling water-circulation is maintained by a pump, a special condensing coil being arranged under the fore part of the carriage. A feature of the Delahaye car is that the speed of the motor is not regulated by the electric ignition device, but by varying the quality of the explosive mixture allowed to pass to the explosion chamber, the control being by means of a small pedal. The frame is built of steel tubing, the weight complete being about 19 cwt. A maximum speed of 27 miles an hour can, it is claimed, be attained.

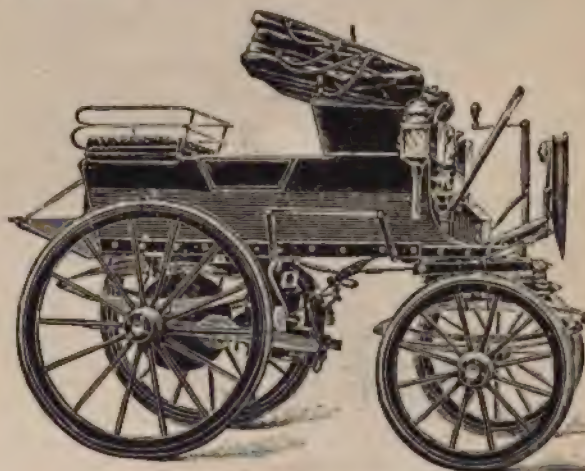
The main feature of the exhibit of the Southern Motor-Car Co., of 59 Brixton Road, London, S.W., is the "Georges Richard" light two-seated petroleum motor-carriage known as the "Duke," French built, and very much on the lines of the well-known Benz carriages so far as the motor and power-transmission are concerned. The motor is of the

single-cylinder type, capable of working up to 3¾-h.p. It is located in the rear of the vehicle; its normal speed is 750 revolutions, but it may be varied from between 300 and 1,200 revolutions by varying the amount of carburetted air allowed to pass to the explosion chamber and by the electrical ignition. The cylinder is water-jacketed. Three changes of speed—5, 12 and 20 miles per hour—including a new hill-climbing gear, are provided, the transmission being effected by means of belts working on fast and loose pulleys. The speed levers are all mounted on the steering standard. Two brakes are fitted, one acting on the rear road-wheel tires, and one, a band brake, acting on collars attached to the rear wheels. The last-mentioned brake is so arranged that when applied the driving belts are at the same time shipped on to the loose pulleys, thus disengaging the motor from the power transmitting mechanism.

Gasoline motor carriages and cycles are also shown by the Ariel Cycle Co., Ltd., of Birmingham, La Societe des Voitures Automobiles Decauville, of Paris, La Societe Francaise d'Automobiles, of Paris, (fitted with Gaillardet motor illustrated in a recent issue of the Horseless Age); Marshall & Co., Manchester (Hurtu), Yorkshire Motor-Car Co. (the doctor's carriage referred to in London Notes last week); the Motot Carriage Supply Co., London, two German-built Daimler lorries of ugly design, a German-built Daimler wagonette, the Prince Albert two-seated carriage, the "Motor-Wheel," Simms' petroleum motor, Simms' magneto, electric ignition device, etc.

ELECTRIC VEHICLES.

The display of electric vehicles is a most meritorious one, although regret has been expressed at the absence of the well-known "Columbia" vehicles of the Columbia Automobile Co., Hartford, Conn.



HEADLAND CONVERTED MAIL PHAETON.

Headland's Patent Electric Storage Battery Co., Ltd., of 12 Pall Mall, London, S.W., exhibit four different types of electric vehicles, the leading feature of all of which is the Headland accumulator, which is claimed to be constructed with a view of giving great mechanical strength, at the same time permitting of high rates of discharge and securing freedom from buckling and disintegrating of paste. The vehicles shown are—a converted horse-drawn mail phaeton, a three-seated phaeton, a two-seated phaeton, and a four-seated Victoria. The first-named has a 3-h.p. motor, driving the

rear axle by bevel gearing. Three speeds are provided for—3, 7 and 14 miles an hour. They are obtained by grouping the 40 cells of the battery, which has a capacity of 150 ampere-hours, in the parallel-series method. The carriage has a traveling capacity of about 35 miles with one charge. The other vehicles differ only in the transmission gear—in the two-seated phaeton the motor drives the front axle by chain-gear; in the three-seated phaeton the front axle is driven by worm-gearing, and in the four-seated Victoria the motor is geared to the front road-wheels by pinions engaging with internally-toothed rings bolted to the wheels.

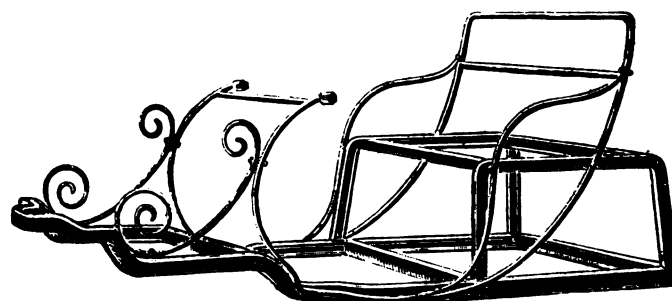
A newcomer in the field of electric vehicles is the Electrical Undertakings, Ltd., of Miller street, High street, Camden Town, N.W., which is showing a new type of electric vehicle, built on Leitner's system. Two vehicles are shown, a four-seated sporting trap and a two-seated buggy. Two motors, of the Lundell type, and of $2\frac{1}{2}$ -h.p. each, are provided—one to each of the rear road-wheels—the connection being by means of spur-wheels on the motor shafts gearing with internally-toothed rings on the rear road-wheels. The battery consists of 40 Leitner accumulators, the capacity and weight of which are given as respectively 120 ampere-hours and 5 cwt. The controller is adapted to give no less than six forward speeds, ranging from 2 to 28 miles per hour and two backward. The motor is so arranged that in descending hills it can be reversed and employed in recharging the batteries. The weight of the carriage complete is 16 cwt. 28 lbs., the capacity of the battery being stated to be sufficient for a run on ordinary roads of 70 miles with one charge. Both these vehicles were built by J. M. Quinby & Co., carriage builders, of Newark, N. J., U. S. A. The buggy won the hill-climbing contest of the Automobile Club recently.

Another interesting exhibit of electric vehicles is that of the Electric Motive Power Co., Ltd., 74 Caistor Road, Balham, S.W., of which several types are shown. The first is a somewhat novel form of vehicle, being a two-seated three-wheeled electric carriage, having a varnished walnut wood body, the total weight, with two passengers, being under 8 cwt. It is propelled by one motor of 2 h.p., the current to which is supplied by 22 Crowdus cells of 14-lb. weight each, the battery complete weighing 2.75 cwt. An average run of 35 miles can, the makers state, be relied on at a speed of 12 miles per hour, which can be varied from that to zero. The steering and control are effected by one lever connected to the front steering wheel. The motor drives the rear wheels, which are fixed to a live axle, through an inclosed single reduction bevel gearing and differential box. The driving wheels, which have a diameter of 26 in., are fitted with pneumatic tires. The frame is built up of steel tubes, giving great strength with lightness. Three brakes are provided—(1) an electric brake, this being the one commonly used, and two band brakes, each acting separately on the live axle. The weight complete of this little carriage with motor and cells, is under $5\frac{1}{4}$ cwt.

Another carriage exhibited is an elegant four-wheeled dog-cart, having four seats, the body being of light varnished wood. The driving is effected through an inclosed 5-h.p. motor of the Mackey type, current to which is supplied by 62 Crowdus cells, each weighing 24 lbs., and having a capacity at a four-hour discharge of 264 Watt-hours. The whole battery complete weighs, therefore, 13.25 cwt., and has a capacity of 22 h.p.-hours. The motor is geared to the rear axle through spur gearing. There are four speeds of 3, 6, 9 and 12 miles per hour respectively, obtained by parallel-

ing the cells in a special controller, by means of which the speeds may be varied without breaking circuit, thus, it is claimed, obviating wear and tear due to sparking; an average run of 50 miles with one charge being obtained with a full complement of passengers. Three brakes are supplied—(1) an automatic electric brake, operating to charge the cells, this being the one used under ordinary conditions; (2) a rim-brake, engaging on aluminum plates on the driving wheels; (3) a hand-brake on the live axle, working in both directions. Another novel feature is an arrangement whereby, in actuating the foot brake, the electric controller is returned to zero before the brake proper can be applied. Two electric carriage lamps are provided, and the alarm is given by an electric gong, actuated by a press button in the steering handle. The frame of the carriage, which weighs complete under 23 cwt., is built up of steel tubing.

The Mackenzie Carriage Works, of 26 Walnut Tree Walk, Kensington Road, Lambeth, S.E., exhibit three electric carriages—a Riker two-seated mail phaeton, a Mackenzie four-seated sporting dog-cart, and a Mackenzie phaeton. The electric energy in the Riker carriage is furnished by a battery of 40 Headland accumulators of a capacity of 90 ampere-hours. The Mackenzie dog-cart is built very much on Riker lines, but shows a number of detail improvements both in the carriage body design and in the mechanical arrangement. The frame is tubular, the connecting rods controlling the steering of the front wheels being of an improved design. The motor, which in this case is of 3-h.p., is geared by means of spur wheels to the rear axle, a band brake operated by a foot-pedal being incorporated with the spur wheel on the latter. The battery consists of 40 cells of the "Victoria" type, of a capacity of 150 ampere-hours, or sufficient for, it is claimed, a run of 60 miles on one charge, the weight of the battery being 10 cwt. Three forward speeds—the maximum being 12 miles per hour—are provided, these being controlled by a single handle. Among the little details in this car is the fixing of a push-button switch in the steering-bar handle so that the alarm gong may be sounded without removing the hand from the bar, while another is the arranging of the battery chest in such a way that not only the sides but also the top of the accumulators may be quickly rendered accessible. The weight of this carriage complete is 23 cwt. The Mackenzie phaeton is of a very neat design, the electric gear being of the same type as the dog-cart with the exception that the motor is only of $1\frac{1}{2}$ h.p.



CHANNEL SECTION STEEL MOTOR CARRIAGE FRAME.

An exhibit of interest to motor-vehicle builders is that of Rubery & Co., of Darlaston, South Staffordshire. It comprises a motor-carriage frame built up entirely of channel-section steel; it is adapted for a two-seated car, and weighs only 1 cwt. The firm claim that channel-section steel affords

not only a light and rigid frame, but one of great strength. Examples of the various shapes in which channel-sections can be supplied are also on view.

AUTOMATIC EXTINCTION OF TUBE IGNITERS.

A feature of special interest at the Richmond show were the exhibits of those who were competing for Major Barclay's prize for the best means of automatically extinguishing the flame in tube igniters when the vehicle is overturned. A carriage of Major Barclay's was destroyed by fire owing to an upset and he immediately recognized the necessity of improvement in the present system of tube ignition.

Lyon & Whitmarsh, 13 Downing St, Cambridge, one of those competing for this prize, showed a cut-off arrangement fitted to the supply pipe, consisting of a small bell crank lever working a cut-off valve, and attached by a cord or chain to a steel ball an inch in diameter, supported on a bracket in a ring, so arranged that an inclination of 45 degrees is sufficient to cause the ball to drop out of the ring, when its weight upon the lever closes the valve and cuts off the gasoline.

R. W. Buttemer, of St. Mary's, near Godalming, provides a vessel containing water or other suitable liquid, with a tube leading to the burner compartment, so that when pressure is exerted upon the surface of the liquid it is forcibly driven into the hot burner box, instantly cooling the tubes, and extinguishing the flame. To effect this a set of weighted levers are so arranged that should the car overturn one of them is thrown over, and in so doing caused to actuate a valve which lets air into the water vessel either from the pressure tank of the petrol supply, or from a special reservoir provided for that purpose, when, of course, the water in the container is at once blown through the tube on to the burners. Mr. Buttemer also arranges as an alternative that the lever may release a piston, or let water into a mixture of dry acid and alkali, or let acid drop on to a carbonate in order to obtain pressure where no pressure tank is used.

First Electric Express Wagon.

The first electric express wagon in this country was tested at Baltimore, Md., July 5th, by the United States Express Co. It was built by the Fischer Equipment Co., of Chicago, Ill., and will undergo further tests at Washington, Philadelphia and New York.

Big Liquid Air Company.

Boston motor vehicle circles were considerably stirred last week by the announcement of the incorporation of the Liquid Air Power & Automobile Co. with a capital stock of \$5,000,000. The incorporators are G. Code, H. Knudson, T. Sewell and E. Teanta of Boston, Mass., and M. Chase of Haverhill, Mass.

The new company is empowered to make and sell liquid air and vehicles and motors propelled by the same.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

The Motor Vehicle Wins in Chicago.

The test case brought by the American Electric Vehicle Co. of Chicago, Ill., whose secretary, Harry G. Osburn, was arrested while driving a motor vehicle, to determine whether the South Park Commissioners had authority to exclude motor vehicles from the park driveways, has been decided in favor of the motor vehicle, Judge Gibbons rendering the following decision:

Monopoly seems to be the inspiration and realization of the times—monopoly of capital, monopoly of labor, monopoly of trades, monopoly of profession. Can we not afford to permit the poor to enjoy a monopoly also—a monopoly of the parks which were purchased and beautified for the recreation, health and benefit of the public? Yes, the parks are theirs, they have become the birthright of the poor, and the man who would destroy their usefulness as the pleasure places of the poor should receive summary and condign punishment.

The parks and boulevards are the sacred places of the common people, and they must not be desecrated by the mammon of iniquity.

This case is important not only as to the power of the Board to pass the order in question, but how far it may go in permitting the parks and boulevards to be used by automobile companies for gain or profit. Our boulevards in and between our park systems have cost us millions of dollars and it would be a very convenient thing for an individual or a corporation to take possession of them, with or without the license of the Park Board, and use them for carrying passengers for hire.

The time may come when the Commissioners will grant licenses for the use of those boulevards, but there is so much territory all around us, there are so many streets, why should not the parks and boulevards be held sacred for the objects for which they were acquired?

The automobile has come to remain with us and we welcome it as a great improvement over horse cars and the ordinary street car. The time is not far distant when no horse car, trolley car or cable car will be permitted to occupy any of our business streets. They have served their purpose. They should be either above or below the surface of our streets.

The Board of Park Commissioners have no right to prohibit any vehicle, used for recreation of pleasure, from using the boulevards so long as it does not endanger the safety of others. It has no right to prohibit the automobile by name any more than the bicycle or tricycle or dogcart, but it has the right and it is its imperative duty to prohibit any vehicle, whether bicycle, horse carriage, or automobile, within the parks to run at a higher rate of speed than four or five miles an hour. Any higher rate of speed endangers the safety of the women and children who resort there for recreation and pleasure. The Board has the power to set apart certain drives or places where they may prohibit vehicles from going, or where they have the facility they may designate what part of the boulevard should be used by bicycles, for example, and may prohibit any other kind of vehicle from encroaching upon that territory. But where there is but one north and south boulevard the Board has not the power to prevent the fortunate owner of an automobile to use that boulevard for pleasure.

Aside from the question of passing an ordinance which is on the face of it unreasonable, the Board has almost plenary power over the parks, and it is well that it should because, as already stated, the parks are a great and growing blessing to the people.

The order in question is void in singling out automobiles by name and placing them under the ban of outlawry, when as a matter of common observation and scientific knowledge there is less danger in propelling an automobile than there is in driving a horse and buggy. The relator is discharged.

Messrs. Carrigan and Osburn were generally congratulated on the victory they had won for the cause of the motor vehicle.

Proposed Motor Vehicle Regulations at Chicago.

The city electrician of Chicago, Ill., has, at the request of the Mayor, sent to the department of law the following letter outlining his reasons for the act regulating drivers of motor vehicles, which the Corporation Counsel is now preparing:

The vehicles are propelled by some mechanical means, either gasoline, compressed air or electric power, using an engine as a means of transmitting the power to the vehicle. The operation of the engine requires that the operator should have some mechanical knowledge in order that he may fully understand how to start, stop and keep it at all times under control.

The apparatus should be operated by a competent man in order that it may be under a continual supervision as to the perfection of mechanical details, so far as they pertain to the stopping, starting and controlling of the vehicle.

The automobiles as proposed to be used will carry a number of persons, whose safety will be dependent entirely upon the operator.

The vehicles are noiseless, and as they are apt to run at a higher rate of speed than ordinary vehicles the operators should be under control of the city.

In conclusion the letter suggests that the ordinance cover the following points:

1. A license should be issued to the operator upon examination by a board, covering his physical condition, mental balance, a reasonable knowledge of mechanical appliances and his familiarity with the parts of the apparatus liable to become deranged.
2. The cost of the license should not exceed twenty-five cents and should be required to be renewed annually.
3. Accidents caused clearly through carelessness of operators of these vehicles should be sufficient reason for revocation of license.
4. Operators of the vehicles of the character described without a license should be punished by a fine of not less than \$5 or more than \$25 for each offense.
5. The speed of vehicles should not exceed eight miles an hour.
6. Such vehicles should be provided with a four-inch mechanically operated bell and approved brakes should be provided for stopping vehicles.
7. The examining board to consist of the commissioner of public works, commissioner of health, and the city engineer, or the city electrician, a secretary for keeping records of the office and make provisions for examinations to be held twice each month.
8. The board should be given the authority to revoke licenses for violation of the ordinance on proof of carelessness or inability of the operators.

New York-Irvington Contest Postponed.

At the suggestion of General Miles and with the consent of Messrs. Barber and Walker, of the Locomobile Co. of America, the proposed contest of motor carriages from New York to Irvington on the Hudson and return has been postponed until early in October, probably the 7th.

It will be noticed that the name of the company manufacturing the Stanley steam vehicles has been changed from the Automobile Co. of America to the Locomobile Co. of America, the word "Locomobile" having been adopted as a trade mark.

The Locomobile Co. begin making deliveries this week and will put out carriages in increasing numbers from this time forth.

COMMUNICATIONS.

Two Questions.

New York, July 5th, 1899.

Editor Horseless Age:

Please be kind enough to tell me through your issue, why explosive engine cylinders are bored larger at the explosive end? Also, is there a mixing valve on the market?

R. T. N.

The two most apparent reasons for slightly enlarging the cylinder bore at the explosive end are, 1st—The piston, being used as a guide for the connecting rod, overruns the edge of the enlarged bore and thus no ridge is formed at end of travel. If the piston moved through a cylinder in which this provision was not provided, and a ridge formed, then, when adjustment was made at crank pin or the other end of connecting rod, the worn place would cause trouble, at once annoying to locate and cure. 2d—The thin space extending around the end of piston in the explosion chamber is filled with explosive material but the space impedes the passage of flame exactly in the same way that the gauze in a Davy lamp or a Brayton engine obstructs by its small openings, and as the flames of explosion dry the internal surfaces this thin chamber does not get quite so high a temperature as it otherwise would. In fact the heavier the oil the greater the likelihood that this space will retain oil that will hold lubricating qualities.

Am not aware that there are any mixing valves on the market capable of ready attachment to other than the machines for which they were designed. Several makers are prepared to supply motor parts either finished or in the rough castings. See advertising columns of Horseless Age.

R. I. C.

More Motor Etymology.

BROOKLYN, N. Y., July 1, 1899.

Editor Horseless Age:

Many fruitless attempts have been made to find a good name for the motor vehicle.

Why not call it "trol" (pronounce short) like "hot," "pot," etc., urging a trol, "trolling," the trol driver, "troller," and if a gentleman trols for sport he is a troleur (pronounce French). There is the word "troll," which is pronounced long, slow. Its meaning besides others is a slow rolling motion. The new word trol, pronounced short and sharp, is well fit to signify a swift rolling motion. In order to specify the motive power of a trol simply use electrol, gasotrol or gastrol, petrol, naphtrol, steamtrol, etc. To describe the shape of the vehicle trolbuggy, perhaps, abbreviated to troggy, trolomnibus to trolibus, trolbuss, trolsulky to trolky. This would generate "electrolibus" for "electrically driven omnibus" or petroleator for "a motor phaeton driven by petroleum. But in average conversation the indication of the motive power would be omitted.

Finally the tricycle could be called—borrowing from the French—"trolette," which would form petrolette, electrolette, whilst the motor bicycle would become trolbyke or trolbike.

There is no doubt the word "trol" is as short as practical for any combination desired and has a strong justification in this place.

SUBSCRIBER.

Favors a National Protective Association.

Chicago, Ill., July 8th, 1899.

Editor Horseless Age:

I herewith inclose you a copy of the opinion of Judge Gibbons in the habeas corpus case which we have been prosecuting in the matter of the hostile legislation of the South Park Board of this city.

It is with feelings of gratification and pleasure that we record our victory in this case, inasmuch as it will establish a precedent for the owners of automobiles in other cities to secure the repeal of prohibitive or hostile legislation against the operation of these vehicles in parks and boulevards.

I would suggest that a movement be started for the organization of a national association of those interested in the automobile industry. Such an association with a secretary, whose time could be exclusively devoted to the best interests of the industry, would be a powerful and effective means in securing the repeal of obnoxious legislation, and also in preventing hostile legislation in the future.

I have been active and alert at all times to secure constitutional and personal rights in the operation of our vehicles on the parks and boulevards in this city, and am confident that no hostile legislation will be enacted hereafter in this city, but expect that ordinances will be passed regulating speed of vehicles, also imposing such other restrictions as we naturally expect.

Trusting that the above suggestion in reference to a national association may find an active response on your part, I beg to remain,

Faithfully yours,

C. E. CORRIGAN,

Gen. Mgr. American Electric Vehicle Co.

International Motor Races.

Providence, R. I., July 2.

Editor Horseless Age:

A test between international competitors should be based upon such qualities as to make the contest indicative of the state of the art in the several countries as well as the skill shown by the operators. In practice it is altogether unlikely that this result could be attained, unless certain conditions, similar to those adopted in the yachting world, are accepted on each side.

For instance, I would limit the race to track work, the weight of machine not to exceed certain weight, etc., a given number of turns to be made to show manageability. In addition to these, which are intended as speed requirements, all the other qualities of a practical motor vehicle could be submitted for a general test.

In these three factors—minimum weight, maximum speed and manageability—are we, as M. Charron declares, four years in arrears? It is utter nonsense.

Certainly, a machine, here or there, can be built which shall possess extreme speed and be good for nothing generally. The "Jamais Content" of Mr. Jenatzy is a case in point. Here the machine is towed to the race, does its mile or two and is towed home. So far as the state of the art

is concerned, would such a contrivance and such performances add any more than the present efforts of bicyclists, paced by locomotives, etc., to our knowledge of machine construction in a useful direction? Yours truly,

R. I. CLEGG.

Large Motor Carriage Plant on the Hudson.

The Locomobile Co. of America, manufacturers of the Stanley steam carriages have purchased a large tract of land comprising 600 acres at Kingsland Point on the Hudson River, near Tarrytown, N. Y., and will erect a large factory. The factory at Newton, Mass., will be vacated as soon as the new plant is completed.

William Rockefeller is said to be interested with Mr. Barber and Mr. Walker.

Riker Wood-Wheel Delivery Wagon.

The accompanying cut shows a new type of Riker delivery wagon, having wooden wheels.

The wheel base is 68 in. and the tread 59 in. The solid tires are 2½ in. x 38 in. front and 42 in. rear. The weight of the vehicle is 3,600 lbs. and its carrying capacity 1,000 lbs., in addition to the operator and delivery man.

Two motors of 2 k.w. each are used. The controller gives three speeds ahead and two to the rear, the maximum being 9 miles an hour. The total mileage on level macadam on each charge is 30. The usual combination voltmeter and ammeter and electric side-lights are employed.



RIKER WOOD-WHEEL DELIVERY WAGON.

Operating Cost of Horse and Electric Delivery Wagons in New York City.

By G. F. Sever and R. A. Fliess.

During the last three years many descriptive articles relating to the automobile have appeared in the technical press, but up to the present time there has been published no definite data which might be used to indicate whether or not electric operation possessed any advantages. Hence both the general as well as the technical public, could form no definite opinion as to the benefits to be derived from the use, in any particular class of service of either an electric or a horse system.

The purpose of this paper is to present the results of an investigation, carried on during the past year in the city of New York, of the operating costs of the horse and electric delivery service, as at present instituted by the large department stores. This investigation formed part of a graduation thesis in the electrical engineering department of Columbia University.

The present status of the art does not permit of an exhaustive comparison, as some of the data now presented will probably be entirely altered by the rapid developments which are taking place, the art progressing quite similarly to that of the electric railway. That which can be done most successfully is to compare the cost of maintenance of the two above mentioned systems, and if to-day, an electrical system costs less to operate and keep than a horse system, it is simply a question of a short time as to the replacement of the horse by electrical method. Of course in considering the economy of any system, depreciation enters largely as a factor; but, in case of any new system such as is under consideration, the determination of the depreciation of any of the various parts or of the system as a whole, would be difficult and for its solution would require long continued service and close observation. Owing to the short time that the automobile has been in the field in commercial competition with the horse, it has been impossible to collect a sufficient amount of data on this point to make its introduction of value in drawing a comparison between the total operative costs of the two systems.

SECTION I.

SOME DATA ON HORSE DELIVERY SERVICE.

The work done by a horse in moving a vehicle over level ground, consists in overcoming resistance to motion due to friction; it may be conveniently expressed in foot pounds. When grades are encountered, the number of foot pounds of work performed in the same distance will increase. This additional work is necessary to overcome the force of gravity. When on a descending grade, the horse does work in resisting the tendency of the vehicle to accelerate. Hence, when in motion, the horse is continually doing work. The exact amount of work performed by a horse in a day is a very variable quantity. It depends upon many factors, some of which are:

1. Kinds of road surface—macadam, asphalt, etc.
2. The condition of roads traveled over.
3. Topography of the country passed through.

4. Nature of the load.
5. Distribution of the load on the wheels.
6. The horse itself.

The horse is not an automatic machine that can be designed to perform a given amount of work with a given efficiency. It is, on the contrary, a most variable, and at times, willful, source of motive power. The breed, state of health, temperament, environment, adaptation to the load, etc., affecting in a greater or less degree, the amount of work that can be performed in a day by any individual horse. The problem therefore of determining the amount of work done by a horse, under any but very regular and systematic conditions, is one of great complexity. But under regular conditions, the amount of work performed may be quite closely approximated. It is proposed in this section to give the results obtained in an investigation which was undertaken to determine, as closely as possible, the average amount of work performed daily by a certain lot of horses engaged in the delivery service of a large dry goods store in New York City.

It may be well to explain in some detail the exact nature of the work required of this class of horses. The large "department stores," as they are now called, have to keep in operation winter and summer, irrespective of the weather, a delivery service which must be as regular in the fulfillment of its functions as the local steam railroads and street railway systems are in the execution of their obligations. The nature of the service necessitates a highly organized system of delivery by means of small units capable of carrying 700 to 800 pounds, over short distances and with considerable speed. This problem has been met and solved by these stores through the introduction of a horse delivery service composed of many small units, each one of which has its special district to cover and a certain time schedule to follow.

To illustrate more clearly the method pursued, we will follow one of these units through its daily routine. Let us consider the case of a wagon making three deliveries a day. The first delivery starts from the stable at 8 o'clock in the morning and arrives at the store a few minutes later—the stable, in most cases being not far from the stores. Arrived at the store, the wagon receives its load, which varies from day to day, but which will average the year around, not over 800 pounds. This load may be taken as the average load on all trips as the wagon leaves the store. The load decreases as deliveries are made so that, theoretically when the wagon has reached the store again, it should be without load. This, however, seldom happens in practice, as there are many C. O. D. packages in each delivery that must be returned to the store as collection could not be made. Also packages sent out on approval are called for and brought back to the store on each trip. Hence, the load as a general thing, does not entirely disappear before the wagon reaches the store at the end of any one delivery. It may be safely assumed, however, that the average load carried throughout any trip will not be more than 500 pounds. The load having been received, the wagon starts out to deliver its packages.

The following table gives for a certain store, the division of the city into what may be called unit districts, each store having, of course, its own particular scheme of subdivision—this depending upon the volume of its business:

TABLE I.

1	Canal St., to Battery, East and West.....	2 deliveries a day
2	" " " 19th St., East of Fifth Avenue.	3 " "
3	" " " 19th " West of " " "	3 " "

Paper read at the sixteenth annual meeting of the American Institute of Electrical Engineers, Boston, June 28th.

4	20th St	to 40th St., West of Fifth Avenue,	3 deliveries a day
5	41st "	" 59th "	" " .3 " "
6	60th "	" 75th "	" " .3 " "
7	76th "	" 90th "	" " .3 " "
8	91st "	" 105th "	" " .2 " "
9	106th "	" 125th "	" " .2 " "
10	126th "	" 145th "	" " .2 " "
11	20th "	" 50th " East	" " .3 " "
12	51st "	" 80th "	" " .2 " "
13	81st "	" 110th "	" " .2 " "
14	111th "	" 145th "	" " .2 " "
15	All above	145th St. East and West.....	1 " "

It will be observed that on the longer trips only two deliveries are made a day, while above 145th street only one delivery is made. This latter is an all day route and the horse that goes up one day comes back the next—horses being changed at the local stable of this particular store near 180th street.

Let us suppose that the wagon has started on trip No. 7, then it will go from that store to Seventy-sixth street without stopping, the first delivery being made in Seventy-sixth street. To make it easier for the horse and to facilitate the delivery, the driver does what is called "backloading." This means giving a number of packages to his helper or delivery boy to distribute on foot, while he drives to another street, makes some deliveries and meets his boy again at some pre-arranged point. By this method the horse is saved a great deal of work and the time of delivery is much shortened. After the deliveries are all made on the way up, say, between 8th avenue and Amsterdam avenue as far as 90th street—the end of this route—then the wagon comes down delivering between Amsterdam avenue and Riverside Drive to Seventy-sixth street. At this point deliveries stop and the wagon proceeds to the store, there to deposit the money collected on C. O. D. packages and to return undelivered goods. By this time it is usually after 12 o'clock, and the wagon goes to the stable to change horses and prepare for its second trip. The horse used on the morning trip is sent to his stall and a fresh one is harnessed to the wagon. The wagon starts out again at 1 o'clock to load up for another delivery. The same procedure as before is carried out, the wagon usually returning to the stable a few minutes before 5 o'clock. The horse used during the morning trip is harnessed to the wagon again and starts out on the 5 o'clock delivery. This horse returns about 7:30 or 8 o'clock. Hence we see that it takes two horses for every delivery wagon—the horse that makes only one trip on any one day, making two trips on the following day, on a route calling for three deliveries each day. On a route having two deliveries a day, each horse makes but one trip a day.

It has been found that the mileage per wagon per day is nearly a constant, irrespective of the number of trips made. The method pursued which led up to this conclusion, was the following: An odometer was placed on the axle of a delivery wagon in the service of one of the large department stores in the city. This wagon was sent over each of the routes specified in Table I, an accurate record being kept of the number of miles covered by the wagon on each day. This wagon was kept on the various routes in regular delivery service for a period of some three weeks, and the results obtained indicate that approximately the same number of miles are covered by all the wagons in this service each day. This will be readily understood when one considers that a wagon, making a trip over an apparently short route, is in reality covering very much more ground than would at first be thought. The density of population in the district which the route covers

materially affects the number of deliveries and consequently the mileage of the wagon. The explanation of the fact that the average mileage per day of the wagons is nearly the same, is that experience extending over many years of service, has taught those in charge the best method of district subdivision which will produce such a proportioning of the work that it shall be equally distributed among the units.

In determining the amount of work done per day by one of these delivery horses, it is essential to know the number of miles traveled by the horse, the average draw-bar pull of the wagon, and the average speed of the horse while in motion. To determine these factors one of the authors spent a number of days on his wheel following delivery wagons of many firms, under varying conditions of load and in many different streets. Attached to the wheel ridden, was an accurately tested cyclometer and an equally accurately tested tachometer. A note book, pencil and watch completed the outfit, and the following is an illustration of the method pursued in determining the amount of work done by horses attached to delivery wagons in New York City.

The draw-bar pull of the wagon was determined by the use of a traction dynamometer. For the wagons under consideration it was found that the average pull per ton was sixty pounds on ordinary cobblestones at a speed of seven miles per hour. On asphalt the draw-bar pull was found to be forty pounds per ton at seven miles per hour. The unit under consideration was composed of a wagon weighing 1,300 pounds, drawn by a horse weighing 1,100 pounds. Each average weight of the driver may be taken at 150 pounds, and that of the boy at 125 pounds. Hence the total weight of the unit without load was 2,675 pounds. To this must be added the average load which may be considered as being 500 pounds. Adding this to 2,675 pounds we have as the total weight of the unit 3,175 pounds. The weight causing the draw-bar pull, however, is 2,075 pounds. The test recorded below was approximately one-half on cobblestones and one-half on asphalt. The true average draw-bar pull may then be taken as having been fifty pounds per ton during the test.

The results given in the following table may be considered as showing relatively the average amount of work done by a horse during about four and a half hours in harness in delivery service.

(Table omitted by author.)

From the above data we find that, starting from the store, the average speed while in motion was 6.7 miles per hour. The actual running time was one hour and thirty-six minutes; time at rest two hours and twenty-eight minutes.

From the time the horse left the stable until he returned to it was four hours and fifty-two minutes. The time taken to load at store was forty-six minutes. The time to run from stable to store was two minutes. Hence, the actual time the horse was working from the time he left the stable until he returned to it was one hour and thirty-eight minutes; time at rest three hours and fourteen minutes.

It will be noticed that the horse was at rest and doing no work for nearly two-thirds of the time.

Taking the draw-bar pull as found, at fifty pounds per ton, the number of foot pounds of work done by the horse in traveling eleven miles was $50 \times 58,080 = 2,904,000$ foot pounds, or at the rate of 1,781,596 foot pounds per hour, which is at the rate of 29,693 foot pounds per minute. This delivery horse then exerted nearly .9 of a theoretical H. P.

for one hour and thirty-eight minutes. This was all the work done by this particular horse on this day. The following day this same horse made two trips over the same ground. From this data the average work done per day the year round by a horse in this class of service, may be taken to be not over 16.5 miles at fifty pounds per ton, at a speed of seven miles per hour. Other data bears out this conclusion. It is quite probably that on some special occasion a horse may be called upon to do more than is shown above, but the average work, day by day, for the year is not more than this. In fact, experience has shown that a horse in delivery service in New York City cannot average over fifteen miles a day for six days a week and be expected to render good service for any reasonable length of time.

The length of the working life of a horse in this service is seldom over five years. At the end of this time he has depreciated in value at least 50 per cent. and cannot be sold for more than half his original cost.

The time that a horse is in harness per day the year round will not average more than seven hours, and we have seen that he is only working a small fraction of this time. However, for the purposes of this paper, it will be considered that a horse can do a greater amount of work, day in and day out the year round, than experience has indicated that he accomplishes.

We will assume, therefore, that it is possible for a horse to do twenty-one miles a day under a draw-bar pull of fifty pounds, at seven miles per hour and be in harness eight hours a working day, the year round.

The number of foot pounds of work done per day by a horse, under this supposition, would be 5,280,000. This is at the rate of 29,333 foot pounds per minute, or the horse is working at the rate of .89 of a theoretical H.P. for three hours per day. This, of course, refers only to the time in actual motion.

Having established the amount of work that a horse is to do per day, it is now necessary to ascertain how much it costs to do this work. The basis upon which this calculation can most readily be made, for comparison with other values, is the ton mile; that is, how much it costs to transport a ton one mile over a level road under ordinary conditions; the ton weight to include everything that enters as a factor in causing the draw-bar pull of the wagon. These factors are, the weight of the wagon, weight of driver and boy, and weight of load carried. In order to facilitate the calculation, the data collected has been condensed into a table and is given below. This table represents the results of a personal canvass of a large number of stables for delivery and for general livery service. The figures given are the lowest that were procurable in New York City:

TABLE III.

TABLE OF ITEMS ENTERING INTO THE CALCULATION OF THE COST OF MOVING A TON A DISTANCE OF A MILE ON LEVEL GROUND, IN LIGHT DELIVERY SERVICE IN NEW YORK CITY.

1. Cost of food per day for one horse.....	32.00 cts.
2. Interest on cost of wagon (at 6 per cent. per annum) per day, original cost of wagon, \$312.....	5.13
3. Interest on cost of horse (at 6 per cent. per annum) per day, original cost of horse, \$125.....	2.06
4. Interest on cost of harness (at 6 per cent per annum) per day, original cost of harness, \$55.....	.90
5. Part of stable rent charged to each horse per day (cost of stable, \$40,000. Int. at 6 per cent. = \$2,400) 46 horses in stable, part of rent chargeable to horses = \$1,578.55.....	9.39
6. Part of stable rent chargeable to each wagon per day, 24 wagons in stable.....	9.39
Part of rent chargeable to wagons = \$822.85.	
7. Part of cost of attendance chargeable to each horse.....	13.66
4 men to take charge of 46 horses at \$11 a week per man—\$44 a week for care of horses.	

8. Shoeing per horse per day (\$2 per month a head, the year round).....	6.60
9. Driver per wagon per day, \$12 per week.....	171.42
10. Boy helper, \$8 per week.....	114.28

Total cost of one wagon, one horse and attendance per day..... 364.83 cts.
It is to be understood that this table represents the actual cost per day, to a stable in the city, for a wagon and horse, the figures given being those of a stable connected with one of the large dry goods houses in the city.

Assuming 500 pounds as the average load carried by any one wagon per day, the total weight of the unit which causes the draw-bar pull, as found before, is:

Wagon.....	1300 lbs.
Driver.....	150 "
Boy.....	125 "
Load.....	500 "
Total.....	2075 "

Hence, draw-bar pull being taken as fifty pounds, the cost to move one ton twenty-one miles may be taken as 364.83 cents, the cost per ton mile being then 17.373 cents.

Taking another case where the two horses and the delivery wagon are considered, and assuming the most ideal conditions, we find the following:

TABLE IV.

Supposition:

One wagon making three deliveries a day of 800 pounds each—assuming 500 pounds average load as before, making a total delivery per day—2,400 pounds.

To do this will require two horses, one wagon, one driver and one boy. The cost per day of this outfit from Table III is as follows:

1. Food for two horses.....	64
2. Interest on cost of two horses.....	4 12
3. Interest on cost of wagon.....	5 13
4. Interest on cost of one set of harness.....	9
5. Stable rent chargeable to two horses.....	18 78
6. Stable rent chargeable to wagon.....	9 39
7. Attendance on two horses.....	27 32
8. Shoeing for two horses.....	13 20
9. Driver.....	171 42
10. Boy.....	114 28
Total.....	428 54

The cost of delivery per pound is then .17856 cents. If we assume that in doing this work the wagon was out twelve hours and is in motion one-half its time, going at a speed of seven miles per hour while in motion, then the wagon will cover forty-two miles per day. Under these conditions the cost per ton mile is 10.2 cents. This is also the cost per car mile.

If we consider the load only, it costs 10.2 cents per 500 pounds per mile, or at the rate of .0204 cents per pound per mile.

If we assume that on the three trips the deliveries average 50 per trip, then 150 deliveries were made per day. This is at the rate of twenty-five deliveries an hour or one delivery in 2.4 minutes. It is well to call attention here to the fact that a wagon sometimes is called upon to make as high as 100 to 150 deliveries on a single trip and the average rate of delivery may be taken as not over twenty-five deliveries an hour. Hence, it evident that the case considered in Table IV is for ideal conditions only. The weight per package under our supposition is sixteen pounds and it is not often that the packages will average over ten pounds.

The results deduced from Table IV, it will be understood, represent the lowest possible figure under the conditions now existing in the stable under consideration. Therefore, if in making a comparison between the costs of operating a horse and an electric delivery service under identical conditions, the above figures are used, all possibility of error in favor of the electric automobile would seem to be eliminated.

To be continued.

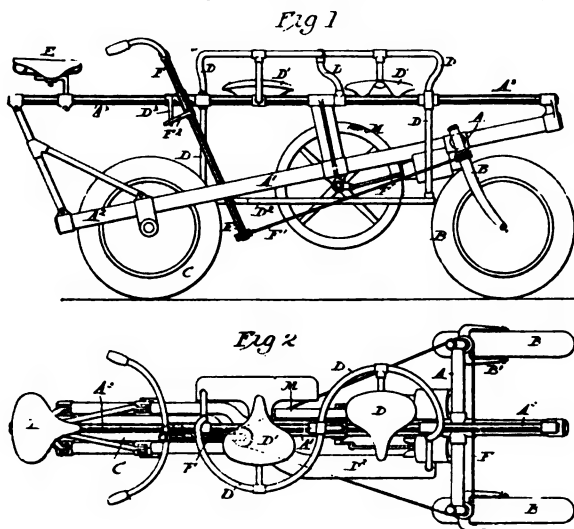
MOTOR VEHICLE PATENTS

of the world

No. 627,523.—Motor Vehicle—Edward J. Pennington, Walton-upon-Thames, England Application filed December 30, 1897.

This invention relates to the steering of vehicles, especially motor vehicles, being particularly applicable to tricycles, since one of the objects which I seek to attain by its use is to increase the safety or stability of the vehicle in going around corners.

The object of the invention is to throw the center of gravity of the vehicle or the passengers or load, or both, toward the center of the circular arc described by the vehicle, so as to counteract the centrifugal force operating in the opposite direction. This effect may be obtained either by tilting the necessary parts of the apparatus so as to relatively lower those parts to the inside of the curve and to raise those to the outside of the curve, or it may be effected by bodily moving the necessary portions, particularly the load, to that side of the vehicle adjacent to the inside of the curve. Various mechanical devices may be employed to effect this purpose.



The framework of the tricycle may be of a rigid T shape, the two leading steering wheels being carried upon the cross and the driving wheel in a fork at the back of the stem of the T. Upon this framework, which may be permanent in its relation to the carrying wheels, is pivoted the frame or platform which carries or forms the seating accommodation of the vehicle. The pivoting would be upon a longitudinal axis, so that the seats would tilt to the right or left of the central line of the vehicle. The movement may be effected by inclined planes, cranks, levers, or the like, preferably connected directly or indirectly with the steering mechanism, so that when the steering apparatus is turned to direct the vehicle in a curve to the right hand the seat or seats at that side of the vehicle will be lowered and the seat or seats at the other side of the vehicle will be raised, and vice versa.

In the case particularly of a vehicle intended always to go around curves in the same direction, as in the case of a pac-

ing vehicle for cycle tracks, the seating arrangement may be pivoted at one side of the vehicle and the other side either raised or lowered, the effect being substantially the same as that already described.

If preferred, the whole frame may be moved in relation to the wheels, the forks containing which may be connected with T or equivalent frame by vertical slides, which may be set to a circular sweep, so that while the wheels maintain their same positions in relation to the ground the T frame would vary, one side approaching the ground and the other receding from it.

Where it is desired to affect the driving portion of the vehicle only, the stem of the T may be jointed or the connection between the T and the cross may be jointed, so as to allow of the necessary movement of the back or driving portion of the frame in relation to the front portion of the frame, which would carry the seating accommodation and would always remain substantially parallel to the ground.

Where the load is moved bodily sidewise, the movable portion may be carried upon slides, slings, links, or equivalent and moved by any convenient arrangement of levers, screws, or other suitable devices operating, as before, in conjunction with the steering.

BRITISH PATENTS.

No. 5,839.—Battery Box and Tray for Motor Road Vehicles—George Herbert Condict, New York, U. S. A.

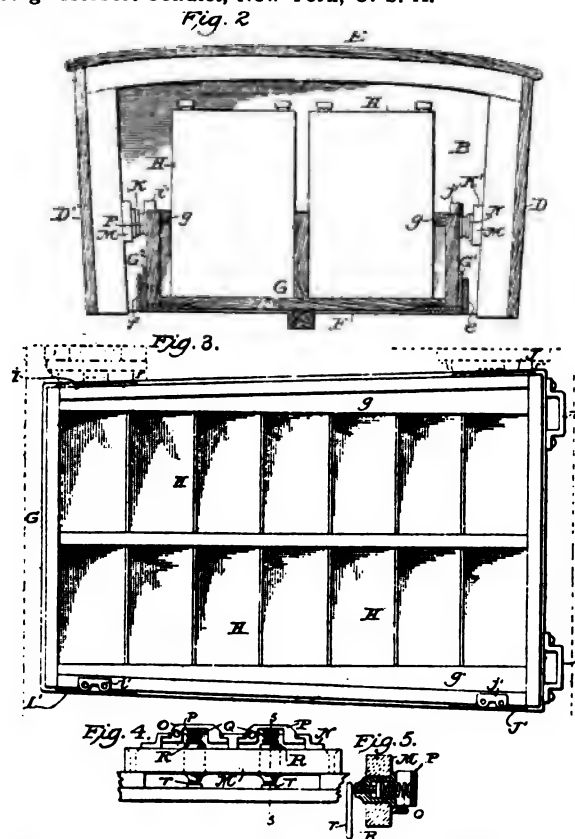


Fig. 2 is a transverse cross section of the battery box.

Fig. 3 is a plan view of a battery tray, showing also in dotted lines, a portion of the battery box with contacts.

Fig. 4 is an enlarged detailed view of one of the stationary contacts in the battery box, and Fig. 5 is a sectional view thereof on the line 5, 5 of Fig. 4.

In the drawings, A is an electric cab. B is the battery box, which is closed by the hinged door C, and has the sides D D', the top E and the bottom F. Two pieces of angle iron e f are secured to the bottom F at the proper distance apart to form supporting and retaining tracks and are arranged at an angle to receive the tray and to securely hold it when fully inserted. G is the tray constructed of insulating material, as wood, vulcanized fibre, hard rubber, or the like, but, as indicated, it is of wood. Its interior is rectangular in form, so as to contain a standard number of battery cells H. The exterior of the tray is made wedge shape in form, being narrower at its front than at its rear end. In this instance, two tapered bars of wood g g' are interposed between the batteries and the sides of the tray to hold them securely in position. Upon the exterior of the sides of the tray are secured two pairs of stationary metallic contacts I I', J J' and these correspond in position with and engage similar contacts K K' L L' fixed to the sides of the interior of the battery box. Handles or catches i i are attached to the rear end of the battery box connecting with mechanism for drawing it out or pushing it in. Angle irons G', G'' are secured to the lower corners of the tray to correspond with and slide upon the angle irons e, f forming ways in the bottom of the battery box.

The contacts I I', J J' of the battery tray G are strips of good conducting material which are fixed permanently thereto, and are provided with lugs i' j' to which the cells are connected. The contacts K K', L L' of the battery box are yielding or elastic in their construction and may vary considerably in form.

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The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

Motor Vehicle Industry.

ESTABLISHED 1895.

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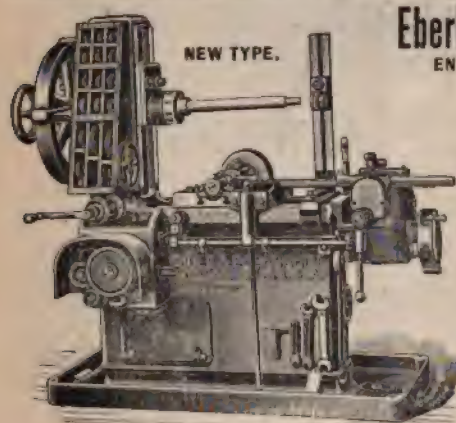
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THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS

VOL. IV.

NEW YORK, JULY 19, 1899.

No. 16.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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French Motor Cab Trials.

The cab and delivery wagon trials which took place in Paris last month were more successful than last year's, the vehicles showing greater regularity, reliability and economy of operation. As to the most interesting factor in the cost of operation of electric vehicles, namely, the maintenance of the batteries, nothing could be proved by service of such short duration. The makers of these vehicles claim that this item is of little consequence in the sum total of expense, but the nature of the storage battery and the history of its use in street railways, lend strength to the belief that, in spite of recent improvements in the mechanical construction of batteries, it must still remain a significant item in the final cost of operation. The storage battery tests undertaken by the Automobile Club of France will no doubt shed light on this matter. The petroleum vehicles acquitted themselves with credit, cov-

ering the routes quicker than the electrics, and with a smaller consumption of fuel than they required last year. No radically new vehicle took part. The weight of the vehicles varied from about 2,500 lbs., the weight of the petroleum cab of Panhard & Levassor, up to four tons. (Jenatzy electric delivery van.) The same tests to determine manageability, brake efficiency, speed changes, etc., were made. The loads carried by the electric vans were from half a ton to a ton and a half, the Jenatzy van carrying the latter figure. All of them gave very satisfactory performance.

The chief changes in the electric vehicles over those of last year are in matters of detail. The batteries used were a new type of Fulmen called the Blot-Fulmen, having ebonite instead of celluloid cases and Planté positive plates.

In the absence of any data in regard to the durability of batteries in vehicle service it is impossible to decide as to the relative economy of the two systems. Other considerations besides bare economy complicate the problem in many ways. However, the verdict of last year, that the electric cab or delivery is best for public or large service, while the petroleum is best adapted to the wants of the private user, is somewhat weakened by this year's performance. Perhaps equal economies could be effected by operating petroleum vehicles on a large scale. At any rate it seems demonstrated that the claims of the electric interests to a monopoly of urban work are not borne out. Gasolene, steam and possibly kerosene also have urban work to do.

Machinery and Tools.

The company which starts out with ample capital to manufacture motor vehicles has a decided advantage in equipping its plant. The motor vehicle is a machine in the production of which high-class machinery is absolutely essential. In order that its various parts may be turned out rapidly, cheaply and accurately the very latest devices of our machine

tool makers must be employed and the ingenuity of the mechanical engineer must be further exercised in the designing of special tools to perform certain operations more perfectly and expeditiously than can be done with any devices now in the market.

It was to direct attention to this subject and keep it before the pioneers in this industry that the department of "Machinery and Tools" was established. To add new interest to this department we have invited Mr. Clegg, one of our regular contributors whose writings are generally appreciated, to contribute a series of articles on machinery and tools with particular reference to the motor vehicle factory. He will find occasion in the course of this series to suggest attachments and improved devices which he thinks might properly be introduced in the motor shop. Readers of the Horseless Age can assist the author and benefit the industry if they will follow him carefully, supplementing and criticising freely to bring out as many phases of opinion as possible. With respect to interchange of views in print the American motor student does not compare favorably with his English co-worker. Whether this reticence is due to modesty or secretiveness it is short-sighted and should be broken by a freer expression among motor vehicle experimenters and manufacturers. All would be benefited by it.

• A National Protective Association.

We recall to our readers the letter of C. E. Corrigan, published in our last issue. In his communication Mr. Corrigan, who won the suit against the Chicago Park Commissioners recently, recommends the immediate organization of a national protective association, the chief object of which should be to press similar suits in various parts of the country in order to establish the rights of the motor carriage to an equal use of the highways with horse vehicles.

A national organization such as Mr. Corrigan suggests could be made a strong moral influence in favor of good roads and the motor vehicle in general. The prosecution of a few suits for the maintenance of the rights of the motor would doubtless be found necessary, but the association, we fear, would be in danger of making a mountain out of a molehill by greatly magnifying the opposition to the motor vehicle existing in the United States to-day. Public sentiment is overwhelmingly with them, and public sentiment determines the action of public officials. Makers of law or its executives, who unreasonably restrict or impede the use of the motor vehicle from this time forth will rouse such a storm of criticism that they will be glad to recede from their position in any way consistent with official dignity. Hence harsh and aggressive measures are neither necessary nor advisable in upholding the rights of the motor vehicle. Patience and prudence will accomplish much more in the end.

The nucleus of an organization of this character could best be secured by an affiliation of the several local automobile clubs which are already formed or are in process of formation in New York, Boston, Philadelphia and Chicago. The New York club, as the first one chartered here, might with propriety take the necessary steps if it is deemed timely to form a national association next fall.

Word Coining Enough.

We give space to more word coining in this issue, but for the last time. The Horseless Age is not looking for a name for the new vehicle. The name was already in use before the Horseless Age was established, a name which had been adopted by the natural processes of evolution, and these processes will again assert themselves after the flurry of speculation is past. All this fantastic philology is ephemeral and ridiculous. The terminology best suited to our needs here in the United States is the motor terminology, the adjective noun "motor" forming a prefix before all the familiar names for road vehicles. In course of time the specific names will often be dropped in common speech and the word "motor" alone will stand for "motor vehicle," when the particular class of vehicle referred to is not important. The same word will also serve as a verb to express the act of driving a motor vehicle. For example, we can say: "We motored down to-day," meaning that we came down on a motor vehicle—carriage, bicycle or tricycle is not material—just as we can now properly say that we "pedaled" down on a bicycle.

These questions of usage settle themselves according to natural laws, regardless of the frantic efforts of word coiners to foist their barbarisms upon the language.

Motor Vehicle Wheels.

The other day the editor was shown a badly wrecked wire drive-wheel which had formed part of an electric carriage recently purchased, but which had proved wholly unequal to the sandy roads of the seashore, where the owner had taken his carriage for the summer outing. Immediately on striking a stretch of deep sand the wheel had buckled and collapsed. An examination revealed a general weakness of construction, suggesting that the manufacturer had modeled his wheel after the bicycle wheel and had greatly underestimated the strains that come from all sides to try the motor carriage wheel. The bicycle is a false guide to the motor vehicle manufacturer, who must either work out his problem on independent engineering lines, or turn out worthless bric-a-brac which might grace a parlor floor, but is out of place on a road.



FIG. 1.

fact that yielding tires are at present (practically) indispensable amounts to a tacit acknowledgment of the prevalent inferiority of roadway and pavements. The universal cry of the automobilist is for good roads, and no one improvement will do more to create a giant industry.

Should the pavements ever be so improved as to render the rubber tire unnecessary, would the steel tire do the work? The bearing of this question upon the heavier class of automobile drays, vans, etc., led the author to cause trials to be made touching this subject. Tests were made with a vehicle, having two driving wheels, supplied with smooth, wide-faced steel tires, 72" in diameter, carrying 60 per cent. of load. The approximate draw-bar pull was ascertained on various kinds of pavement, dirt and gravel roads and macadam, on the level, and on grades, wet and dry. It was found that under the most adverse circumstances, ample adhesion could be relied upon for any conditions liable to be met. Soapy and greasy Belgian block pavement was found to give most trouble, but even here, 20 per cent. drawbar pull could easily be relied upon, with some, but not serious, slipping.

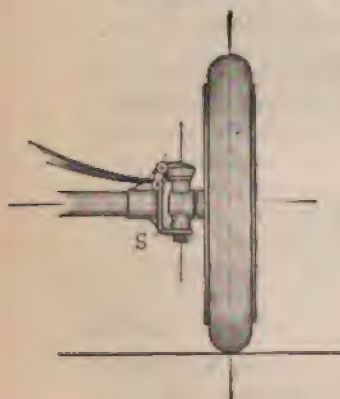


FIG. 4.

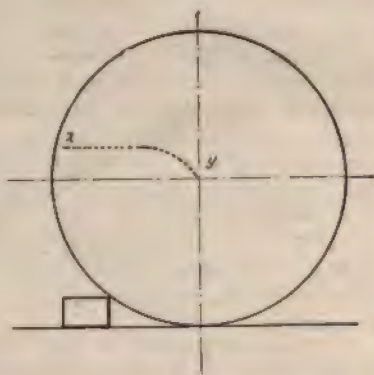


FIG. 5.

A lasting impression of the adhesion and value of smooth tires for road traction, is made by seeing a vehicle of this kind ascending a 20 per cent. grade on an ordinary gravel road and rising easily, uphill over a 4" x 4" timber, placed in front of first one and then both the driving wheels, working as well on the wet portions as on dry.

The designer of the automobile is confronted with some practical problems which have not received attention at the hands of the railway engineer. For instance, in the simple matter of rendering the vehicle directible and easily controlling the guiding mechanism. Especially is this true in so arranging the parts that obstructions will not easily derange the mechanism or throw the vehicle out of its course. When one or the other of the guiding wheels encounters an obstruction of importance, the reaction works back to the guiding handle, tending to "whip" it out of the hand of the operator and throw the vehicle out of its course. (Recall the threshing of pole or thills in ordinary vehicles.) Many attempts have been made to reduce the leverage of reaction, but at best it has remained a problem of some importance. The accompanying illustrations show the method employed by the author. Tests designed to thoroughly test the practical operation of the device, and especially to compare it with the one ordinarily employed are illustrated in Figs. 3, 4 and 5. It was found that the amount of side-thrust transmitted to the guiding handle was practically in proportion to the leverage measured by the distance between the steering axis and the plane of the wheel, at the height of the point of interception of the obstruction. A 20" controlling handle was connected



FIG. 2.

for equal angular movement with the swivelling axle *s*, the wheels being the same diameter, viz., 32" and loaded with the same weight, viz., 370 pounds. A small obstruction causes so flat a trajectory curve as to be negligible; this curve is seen at *x y* (Fig. 5). I have used, as the height of obstruction, the smallest dimension of an ordinary Belgian paving block, lying upon its side, assuming this to be the standard obstruction to be encountered by the various wheels in these tests. Operating the two devices each a number of times over this obstruction, at different speeds, a moment of effort upon the handle, tending to swing it laterally, or snatch it out of the grasp of the operator, was found to be in the two cases as follows:

Figure 4 ordinary device; mean value for pull = 103½ lbs.

Figure 2 author's device; mean value for pull = 0 lbs.

This shows an entirely different action under practical operating conditions.

It will be seen from the sketch that the steering axis *AB* is made to intersect the plane of the wheel well up from the bottom or ground line, where obstructions are encountered and where they may be met "head on," and therefore entirely neutralized, as has been demonstrated, giving no tendency to deflection of the wheel in either direction.

It is also found that the arrangement gives the vehicle a quality of self-centering, or running straight-forward, *hands off*. This, as will readily be seen, is a natural result of the obliquity of the steering axes. The wheels, when turned, in the act of guiding, describe a conic section, the lowest point of which is the straight-forward running position. Another peculiar feature is, that in this action, each wheel is entirely independent of the other, throwing no stress either upon the connecting or guiding rods. Another excellent effect is the result upon the tires, the act of steering tending to describe a small arc, rather than the usual twisting of the tires. This can be especially noticed when the vehicle is standing still. Fig. 6 shows the inner wheel turned 45°.

This system of mounting the wheels is found to have peculiar advantages on rough roads and over obstructions, preventing entirely the reaction to the steering handle, giving entire immunity from fear of controlling handle being

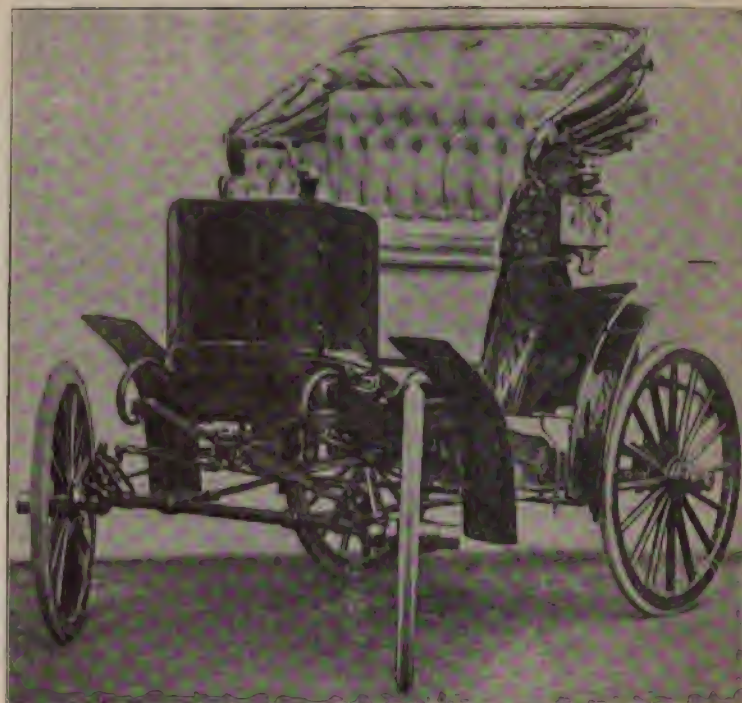


FIG. 6.

suddenly wrested from the grasp of the operator; and on ordinary smooth pavement, instantly assuming the forward position, upon being "given the reins." This feature has been employed upon a number of vehicles both here and abroad, and is well received.

It is found with automobiles that while the best practice in tramway traction can be followed closely in the main, yet the different conditions under which the vehicles operate, weight of motor permissible, height at which the motors are mounted, enormous variation in the rolling friction factor, and other points, allow of departures, which have an important bearing on the motor design and construction. For instance:—With the automobile, only a small motor is allowable. This should be light and yet should deliver all the power necessary in case of emergency. It is found practical to use a motor with a somewhat increased ratio of copper to iron, which should have a high overload capacity, but more than all it is found that the size and weight of the motor can be greatly reduced, if the gears can be practically compounded. This is especially desirable owing to the enormous variation in the rolling friction factor.

Obstructions and grades are encountered, never met on tram-tracks and at the same time may be coupled with soft road, which, owing to the weights necessarily present, would render progress impossible, unless an inordinately large motor were at hand. At such times, often if a few feet only can be compassed the journey can be resumed. It is under these and similar conditions, that the value of the compound gear becomes apparent. One form of this gear, employed in a number of vehicles, has been found to be entirely satisfactory, increasing the leverage of the motor over the load. In case of a motor, with a suitable over-load factor, this gear, while only doubling the leverage, is found to compass anything that



FIG. 3.

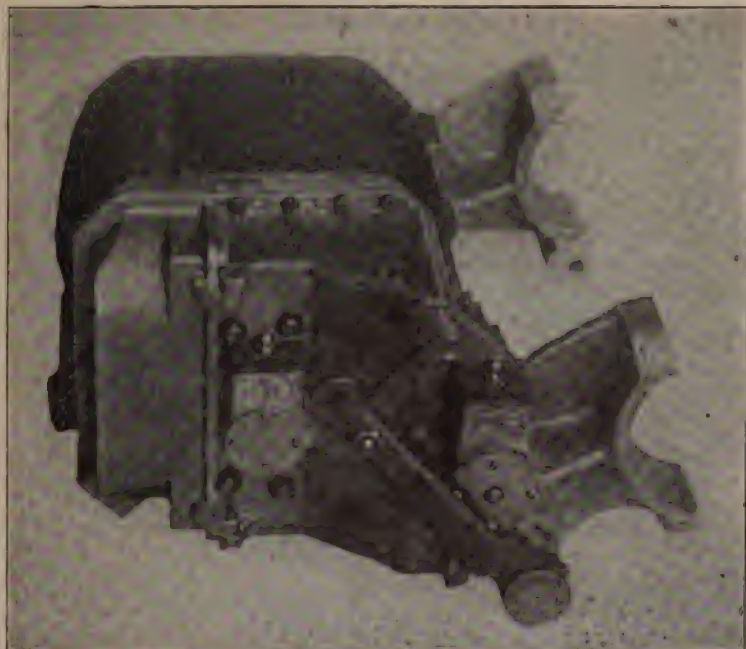


FIG. 7

has ever been encountered in city, park and country service. Any ratio of gearing can of course be employed. By means of the compound gear, the torque is brought up to nearly the slipping point of the drivers without overdraft of current-supply from the battery. The manipulation is by a small handle, usually imbedded in the cushion at the side, it being used only at infrequent intervals. This lever attaches to the upright arm seen in Figs. 7 and 8, the gear being just visible. This compound gear not only enables a small motor to meet an emergency, but has an important bearing upon the storage battery, acting as a safe-

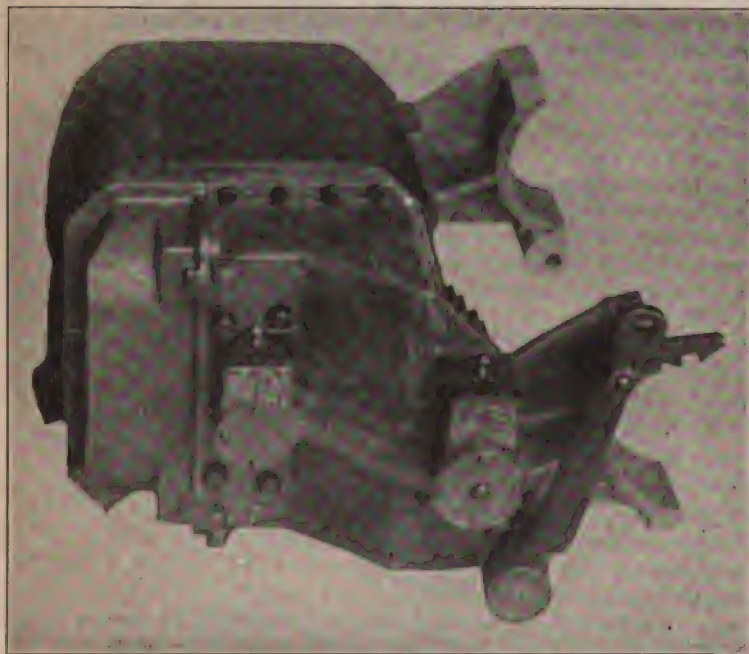


FIG. 8.

guard in a very important sense, preventing, as it does, inordinate over-drafts of electric current, and in this way, enabling lighter plates to be employed, without fear of "shedding" the active material. Another feature of importance in connection with the compound gear is found to be its interlock and interaction with the controller. This feature renders the compound gear entirely successful in the most incompetent hands. The gear cannot be thrown or changed, when the current is on, nor can the current be put on until the gear is entirely thrown to either one or the other of its normal operative positions. This is done automatically and without the knowledge of the operator.

Speaking again of the motor, as a whole, its elevated position and the comparatively open space it occupies, when compared with street car motors, enables the employment of ventilation. This should be designed with care, so as to prevent ingress of water and moisture. The ventilation is especially applicable to the small sized motor considering the heavy overloads to which they are frequently subjected.

In the hands of the non-expert, simplicity of control is found to be indispensable to satisfactory operation.

With the automobile there is one handle, which always should be kept in hand, viz., the steering handle. The question naturally arises, "why not let this handle do all of the work of controlling the vehicle?" In a paper before this body, in 1894, the writer pointed out a system of tram car control, which has since been widely adopted, in which starting, stopping, speed control and brake were confined to the operation of a single handle. This having now been classed as the best practice with tram cars, why not utilize the combination in connection with the steering handle, allowing it,



CONTROLLING HEAD,

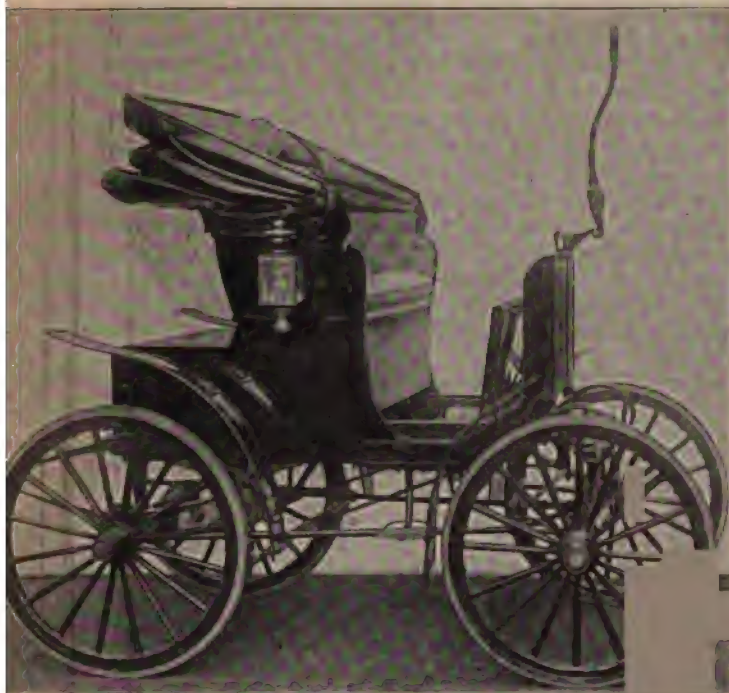


FIG. 11.

by the most natural and almost trivial movements, to do the whole work of operation. In this way, the entire control of the vehicle is simplified to a single handle. The direction of the vehicle is controlled by lateral movement of the lever, the vehicle going in any direction to which the handle is pointed or aimed. Depressing the handle, from notch to notch, increases the speed, and pulling up the handle, as one would draw in the reins, in case of emergency, instantly turns off the current and applies powerful brakes. The intensity of the brakes is increased as the handle is further raised. When the speed has been reduced, by again lowering the handle, any of the speed notches can be readily picked up; the speed and brake being always under instant control, one hand only being engaged. It is apparent that the current manipulation to the motor and brakes requires only an imperceptible effort. In production, the controlling handle is made either to stay where placed, or is self-raising to the brake position, to suit the fancy of the owner. The controlling handle lying nearly horizontal, the "aiming" action in steering completes the simplicity of the operation. (See Fig. 6.)

The controlling head, which is shown in the figures, is supplied with an indicator showing at all times the position of controlling cylinder. Fig. 9 shows first speed and Fig. 10 the third speed, and by touching a button on the side (seen in Fig. 1), the handle may readily be raised to position shown in the figure, for convenience of occupants, especially for getting in and out on driver's side.

In crowded thoroughfares, the brake is the most important feature of the automobile. The French authorities in passing upon vehicles, insist upon this factor more than any other, and it is certainly the most indispensable. Whatever else the vehicle can or cannot compass, it must be possible to stop it, and that instantly, on occasions. The brake should be powerful and at least in duplicate. The carriages illustrated herewith are each provided with three separate brake systems.

The location of the controller beneath the foot board (Fig. 11) is found to present decided advantages in point of convenient interlock and inter-connection with the brakes. The motor cannot be started without first removing all the brakes. This location gives ready access at all times and upon all sides by the hinged floor; gives a natural interlock between the controller and the compound gear above referred to, and also between the controller and charging terminals which are here located. Numerous accidents and even wrecks have been caused for failing to open a special motor switch, when placing the controller in series position for charging. A simple interlock, with the charging terminals entirely eliminates this danger, and indeed the interlocking system throughout the carriage very thoroughly protects it in inexperienced hands; for instance, if the directing indicator (seen in Figs. 2 and 12) is removed, the motor and controller are locked. If the index or pointer of this indicator points forward the vehicle will go forward. If to the rear, the vehicle will go backward. If it points upward, as seen in Figs. 6, 9 and 11, the carriage may be charged, but when in this position, all the conductors of the motor cable are automatically open-circuited, preventing accident. The pointer can never be manipulated until the controller is first open-circuited, and if the index is only partially turned, through carelessness, or otherwise, the controller cannot be operated until the mistake has been corrected.

The motor being light and small, normally should be of relatively "high speed," still farther reducing the weight. A small motor is possible with the compound gear. The double reduction motor possesses advantages of allowing the hand-brake to be operated on the intermediate shaft, thus working through the compensating gear. A small brake, in this way, gives all the leverage necessary, being one reduction back through steel gears with small peripheral velocity, thus acting without noise. Another advantage of double reduction is in keeping all the gears of the power system small, and thus insuring a neater appearance. The somewhat higher speed permissible in the double reduction arrangement also renders



FIG. 12.

possible the bipolar motor, with its higher efficiency, as compared with the multipolar. Every condition tending to higher efficiencies should be considered in connection with automobile equipment, as conserving the resources of the battery. These conditions are not as necessary with systems of tram traction, where the prime source of power is always available.

The location of the controller and current-manipulating switches low, as seen in Fig. 11, and in front of the batteries, avoids hydrogen detonation and eliminates all danger of explosion from spark or opening circuit.

Much has been said of one motor versus two. This is largely a matter of mechanics; it is conceded that one motor gives higher efficiency than two of half the power, and is less expensive to maintain. As even the heaviest strains are comparatively small, the compensating gear, where one motor is employed, is easily maintained, yielding a combination which is far simpler and employs less parts than with a double motor equipment.

The automobile will, for some time, necessarily be in the hands of the inexperienced and non-expert, and while it is not possible to render it "fool proof," yet certain safeguards may be employed in and about its operating devices and charging system, which will materially reduce and almost prevent derangement. The manipulation may be so thoroughly interlocked as to effectually prevent a wrong operation preceding the right one, and rendering it nearly impossible to make a mistake in anything like normal operation. Interlocks and safety devices are used in many branches of engineering; the introduction of automatic interlocking switches is a notable example, having placed steam railway operation on an entirely new basis. After subjecting these devices to continued practical test, and altering them until the requirements seem to have been met, the author is prepared to say that there is no reason why the important results reached in the interlocking switch and signal system, should not be compassed in automobile manipulation, and by devices vastly simpler and inexpensive.

As to charging and care of batteries, it is believed that the differential wattmeter system for ordinary use, coupled with the periodic inspection by an expert from the home office or local headquarters, is the best arrangement now at



FIG. 13. TRAY OF BATTERIES.

our command. The author has found that the differential factor of the wattmeter should be adjustable and should be brought from time to time into step with both the efficiency and charging curves of the battery. These curves change and are peculiarly altered by the time factors. These adjustments are easily made through determinations by the use of hydrometer. This can easily be one of the duties of the periodic inspection above referred to. The practical employment of the adjusting feature, or in fact, any device, by means of which the meter may be kept in step with the battery, is found to constitute such a meter an almost perfect safeguard against the destructive effects of overcharge and overdischarge in inexperienced hands. One tray of batteries is shown in Fig. 13.

With the public conveyance, or a delivery system, operating a number of vehicles from one station, it may not be difficult to secure the services of a single expert attendant, yet for anything like commercial operation, the automobile itself must be entirely successful in the hands of the "raw recruit." Emphasis should be laid on the fact that the driver must be a man familiar, especially at first, with the routes and business in hand. The vehicle must be depended upon to perform successfully, even under trying conditions, without demanding especial thought or attention on the part of its operator, who should simply be a good driver, and who, from an engineering standpoint, would be considered thoroughly non-expert.

Messrs. Barber and Walker Make a Partition of Interests.

Amzi Lorenzo Barber and John Brisben Walker, organizers of the "Locomobile" Co. of America, have made a partition of interests, and the outgrowth is two companies instead of one. Mr. Barber retains the "Locomobile" Co. of America and the factory at Newton, Mass., and has also purchased the old Humber bicycle factory at Westboro, Mass., starting it up for the manufacture of Stanley carriages on July 17. The new officers of the "Locomobile" Co. of America are: Amzi Lorenzo Barber, president; Le Droit Langdon Barber, vice-president, and Samuel T. Davis, treasurer. By September 1 this company expects to be producing 15 carriages a day.

Mr. Walker has selected the name Mobile Co. of America, and takes as his share of the joint interests the Kingsland property on the Hudson River, where a factory 400 feet long and 50 feet wide will be erected for the manufacture of Stanley steam vehicles.

The Stanley brothers will occupy the position of general managers for both companies under contract for one year.

TRADE LITERATURE.

Grout Bros., Orange, Mass., have issued their first catalogue, showing four styles of vehicles, the stanhope first built by them, a two-passenger trap, a four-passenger trap and a delivery wagon, varying in weight from 700 lbs. to 1,400, and propelled by two-cylinder, horizontal gasoline motors.

The back cover of the catalogue is adorned with a picture of the skeleton of a horse, depicted as a fossil and labelled: "These animals were used until about the year 1900."

Operating Cost of Horse and Electric Delivery Wagons in New York City.

By G. F. Sever and R. A. Fliess.

(Continued from page 20, issue July 12th.)

SECTION II.

SOME TESTS ON ELECTRIC AUTOMOBILES FOR DELIVERY SERVICE.

The results recorded in this section were obtained under service conditions, in the streets of New York City. Over sixty miles were covered during the tests recorded below, and all grades between the lower section of the city and Washington Heights were surmounted with the greatest ease. During the tests, various conditions of weather were encountered, including heavy rain, strong head winds and muddy streets, as well as very clear weather, no wind, and dry streets.

During the series of tests, no accidents of any kind happened. It was not necessary at any time to stop the vehicles for repairs—all the mechanical and electrical parts performing their functions with the utmost ease, and with practically no noise, and absolutely no odor.

The method followed during all the tests was the same. It consisted in measuring the watt hours of energy supplied by the storage batteries during the runs, by means of a Thomson recording watt-hour meter, which was accurately calibrated before the test began. The distance traveled by the vehicles was recorded by a tested cyclometer and the speed in miles per hour was noted at any second by means of a tachometer. Placed in series with the watt-hour meter, was a Weston portable ammeter, while a Weston voltmeter was placed across the battery connection at the controller. In this way, instantaneous readings of the power were obtained, while the watt-hour meter gave the total energy used. The Weston instruments were accurate, and every precaution was taken to guard them from any jolts or jars which might have impaired their accuracy.

The first tests to be presented were made upon a vehicle built for a large dry goods store in New York City. The vehicle was intended for the delivery of light goods about the city, and was to be placed in competition with horse delivery service of the same class. The results tabulated below, show the instantaneous power consumption with this vehicle, while traveling over the same ground, at the same speed as recorded on two different days. The column headed "Rain" refers to readings taken during a severe storm which lasted throughout the entire test. The column headed "Clear" shows the consumption of power on a clear day with no perceptible wind.

Table omitted by author.

An inspection of Table V brings us to the conclusion that the power consumption is not greatly affected by change of pavement, as from cobblestones to asphalt. There is, however, a slightly greater power required on wet macadam than on dry, and more power is required on macadam than on asphalt or cobbles. The grades were measured in every case after the tests were completed. In Table VI is given the data obtained during a test run of a little over thirteen miles, in

Paper read at the sixteenth annual meeting of the American Institute of Electrical Engineers, Boston, June 28th.

very bad weather. For the greater part of the trip, a heavy wind was blowing.

Table omitted by author.

The time given in the last column of this table has no bearing on the speed. The speed may have been ten miles an hour while running and yet, owing to "slow-ups," stops, etc., the time occupied in passing from one street to another, where the readings of the time were noted, may indicate a speed of only six miles an hour. The last column was inserted as a check on the trip—the speed in the second column being given as the speed at the time the readings of the voltmeter and ammeter were taken, the watt-hour meter, of course, taking care of the intermediate fluctuations.

A study of Table VI shows us that on grades the speed of the vehicle is very much reduced and that the power required to propel the vehicle at the reduced speed is very large—which is quite natural. The table is instructive in showing the relative proportion of increase of power due to grades. It must be remembered, however, that the comparison is made in this case between level asphalted streets and macadamized hills that were very muddy, and that this condition would cause the variation in power to be greater than in the case of grades of asphalt surface. The average of ten readings taken from Table VI gives as the power consumed on level asphalt the following:

Volts.....	85.3
Amperes.....	23.1

It is to be understood that these ten readings were selected from the table with the idea of eliminating up or down grades. The lowest ammeter reading taken was twenty and the highest twenty-six. Above and below these readings the vehicle was on perceptibly up or down grades. It may be well to note that this wagon was equipped with solid rubber tires; these, as is quite generally recognized, absorb slightly less power than pneumatic tires.

Table VII gives the results obtained during a test in very fine weather. The run was one of 6.25 miles over a continually ascending route.

Table omitted by author.

The watt-hour-meter reading during this test showed a consumption of 1,364.22 watt hours. The wagon alone was weighed on balance coal scales and was found to weigh 3,750 pounds. On this trip it carried three passengers and the instruments used. The total weight was found to be as follows:

Weight of wagon.....	3,750 lbs.
Weight of passengers.....	413 "
Weight of instruments.....	37 "
Total weight.....	4,200 "

The distance traveled was 6.25 miles and the time actually in motion was 52.75 minutes. Therefore:

Average speed in miles per hour was...	8.44 miles.
The watt-hrs per car mile were.....	218.28
The watt-hrs per ton mile were.....	103.95

It should be remembered that these results were obtained during a run which was always tending up hill as was noted above. This becomes quite evident when the average of the twenty-seven readings of Table VII is compared with the

average of the ten readings taken from Table VI, representing level asphalt.

Average of the twenty-seven readings of Table VII:

Volts.....	84.72
Amperes.....	26.25

Average of the ten readings taken from Table VI:

Volts.....	85.3
Amperes.....	23.1

Table VIII gives the results of a run made in the opposite direction to that recorded in Table VII, that is starting on the high ground on which the run of Table VII terminated; it records the power consumed during a run of 7.24 miles. The run ended where that of Table VII began. Thus in the run recorded in Table VIII the tendency was always down hill; this will be appreciated from an inspection of the table:

Table omitted by author.

The watt-hour meter showed a consumption of energy on this run of 1,243.38 watt hours. The weight was the same as previously given—namely, 4,200 pounds. The time in actual motion was 58.5 minutes. The distance traveled was 7.24 miles. The average speed per hour 8.08 miles.

The watt-hours per car mile were.....	171.74
The watt-hours per ton mile were.....	81.08

Combining the results of the watt meter readings for the tests of Table VII and VIII we find that for a total distance of 13.49 miles the average was as follows:

Watt-hours per car mile.....	195.01
Watt-hours per ton mile.....	92.875

The results were obtained under the ordinary service conditions and can be duplicated at any time.

To determine as accurately as possible the lowest value for the power consumption at the different speeds, some special tests were made. A block paved with asphalt which was fairly level between Twenty-fourth and Twenty-fifth streets on Madison avenue, was selected for the tests. The method of procedure was as follows: First, readings were taken while the vehicle was passing between Twenty-fourth and Twenty-fifth streets and then readings were taken when passing back over the same ground, in every case care being taken that the vehicle had reached a constant speed, an appreciable time before the readings were noted. The average of these readings should, of course, eliminate any slight grades, if present, and the average should give the true power consumption for absolutely level asphalt. The readings obtained for the three different speeds of the wagon were:

	Volts.	Amperes
No. 3 speed—10.5 miles per hour....	82	22
	82	20
	—	—
Average.....	82	21
No. 2 speed—5.4 miles per hour....	42	21
	42	18
	—	—
Average.....	42	19.5
No. 1 speed—2 miles per hour.....	21	22
	21	16
	—	—
Average.....	21	19

At No. 3 speed the rate of travel was 15.4 feet per second and the rate of work 1,722 watts. Since a watt represents

0.7373 foot pounds per second the total work required to propel the vehicle at this speed for one second was 1,269.63 foot pounds. This represents a rate of 2.3 H. P. The draw-bar pull was then 52.44 pounds or at the rate of 39.26 pounds per ton. At No. 2 speed the draw-bar pull was 36.3 pounds per ton. The value of the draw-bar pull at No. 3 speed is probably very closely approximate to the value that would be shown at all speeds between five and twelve miles per hour if a dynamometer was used. From the results recorded in Table VII we may take 105 watt-hours per ton mile as quite within the reach of actual practice under service conditions to-day. However, a more conservative estimate of 120 watt-hours per ton mile as a basis upon which to calculate the operating costs of electric vehicles for delivery service will be assumed. Under ordinary conditions a well-designed electric delivery wagon should not consume over 120 watt-hours per ton mile. In support of this statement the following data is presented, these results being obtained while testing a small carriage which, owing to a number of circumstances, had failed to come up to the expectations of the designers. This carriage had been sent back to the shop for some alterations and it was at that time that an opportunity was afforded for making a number of experiments and tests upon it. The point of greatest interest in these tests is the fact that though working under most unfavorable conditions, the watt-hours per ton mile did not reach 120. The weight of this vehicle was 1,200 pounds, over 300 pounds more than the original design called for. With one passenger and the instruments it weighed 1,400 pounds. Its draw-bar pull was found, by a dynamometer, to be over forty-two pounds at eight miles per hour on level asphalt. This is at the rate of sixty-two pounds per ton, and is approximately the same as found for ordinary horse delivery wagons on cobblestones. This excessive draw-bar pull was due to poor bearing design. Table IX gives the result of a run of 9.45 miles with this vehicle on New York City streets.

TABLE IX.

Distance traveled.....	9.45 miles.
Watt-hour meter record.....	771.15 watt-hours.
Average speed.....	8.0 miles per hour.
Watt-hours per ton mile.....	116.5

It is interesting to note that even with this abnormal pull the watt-hours per ton mile were only 116.5.

The test recorded in Table X was a fairly severe one so far as hill climbing and bad roads are concerned. The vehicle on this occasion traveled from Fifty-ninth street up the Boulevard to 137th street and return, taking en route the long hill from 125th street to 137th street on the Boulevard; on the return the hill from 125th street to 117th street was surmounted. The hill climbing part of the trip was over a very bad macadam road surface. The hill at Ninety-sixth street and the Boulevard was surmounted twice during the trip and the carriage covered fourteen miles.

TABLE X.

Distance traveled.....	14 miles.
Time in actual motion.....	1 hour 47 minutes.
Average speed.....	7.8 miles per hour.
Total watt-hours recorded....	1162.29
Watt-hours per ton mile.....	118.57

It is worthy of note that with all the hill climbing, the bad roads and the large friction loss due to bad design, the watt-hours per ton mile only reached 118.57. From the above, 120

watt-hours per ton mile would seem to be a conservative estimate for the power consumption of well designed electric delivery wagons in New York City under ordinary service conditions.

SECTION III.

HORSE VERSUS ELECTRIC SERVICE—A COMPARISON.

In considering the advantages and disadvantages of two radically different systems for the performance of the same work, other things being equal, the cost is the deciding factor. Assuming that all other considerations are equal, it will be shown in this section that the cost of operation, maintenance, etc., of the electric automobile is less than for horses in the light delivery service of New York City, the horse being considered in the most favorable light.

From the results recorded in Section II we are led to the conclusion that, under highly disadvantageous conditions, the power necessary to propel a vehicle through the streets of New York City from the lower part of the town to points situated on the highest ground, including all grades that may be encountered, will not average more than 120 watt-hours per ton mile. That this is a high figure for vehicles of good design and equipment is evident from the results obtained while testing the delivery wagon previously mentioned. The fact that the small carriage never reached 120 watt-hours per ton mile, though working under most unfavorable conditions, should lend weight to this conclusion.

Taking 120 watt-hours per ton mile as a basis on which to compute the power consumed by an electric delivery wagon, we will now compare the results obtained in Section I, Table IV, with the results that would be obtained if an electric wagon were substituted.

From Table IV it was found that the total cost per day for two horses, one driver and one boy, was 428.54c. The wagon was to travel forty-two miles a day—being an average of twenty-one miles per day for each horse. The time in motion was assumed to be six hours. An electric wagon with an average speed of nine miles an hour, could cover this distance in 4.66 hours, thus saving 1.34 hours—the other conditions remaining the same. The cost per day for the electric, assuming cost of power at 5 cents per K. W. hour, is given in Table XIII:

TABLE XIII.

1. Cost of power for 42 mile run, at 5c. per K. W. hour assuming power consumption as 120 watt-hours per ton mile.....	7128c.
Weight of wagon.....	3,750 lbs.
Weight of driver.....	150 "
Weight of boy.....	125 "
Average load.....	500 "
Total weight.....	4,525 "
	2,263 tons.
Watt-hours per car mile, 271.56.	
Watt-hours per 42 car mile, 11,405.00 = 11,405 K. W. hours.	
Taking battery efficiency as 80 per cent.	
Total power to be paid for = 14,256 K. W. hours.	
2. Interest on cost of wagon per day.....	21.4
Cost of wagon, 2,300, at 6 per cent. interest.	
3. Interest on stable rent for one wagon.....	9.39
4. Driver.....	171.42
5. Boy.....	114.28
Total cost per day for 42 miles, one wagon, one driver and one boy.....	387.77c

Therefore, cost per pound of delivery is .16158c., or .01698c. less than the figures for the horse. The cost per car mile is 9.232c., or .968c. less than for the horse. Cost per ton mile is 4.08c., or 6.12c. less than for the horse service. If we consider the load only, it costs 9.232c. per 500 pounds per mile, or at the rate of .018464c. per pound per mile, or .00194c. less per pound than for the horse service.

Attention is again called to the conditions under which this comparison is made. The horse is supposed to be able to average twenty-one miles per day, doing this at the rate of seven miles per hour, under a draw-bar pull of fifty pounds. In other words, he is doing work at the rate of .89 of a theoretical H. P. for three hours per day. The automobile, on the other hand, is to do forty-two miles a day at the rate of nine miles per hour, and the cost of power is assumed to be five cents per K. W. hour. Under these conditions the automobile can do the work of two horses in 1.34 hours less time than they can do it with a saving of .01698 cents per pound of goods delivered or at a saving of 40.752 cents per day on a delivery of 2,400 pounds.

Now, having shown that it is cheaper to use an electric delivery wagon than the present horse delivery wagon—even when the supposition is made that the horse is doing much more work than he really is—it is proposed to make a comparison between the two systems under conditions which actually exist to-day. It was shown in Section IV that the delivery horse does not average eighteen miles per day during the year. We will assume, however, that the horse does travel this distance per day. Each wagon will go thirty-six miles a day under this assumption; hence, the total mileage of the wagon for the year will be 11,268 miles. This assumes that on Sundays the wagon does not go out. Then for fifty-two days a year, at least, the horses have to be fed without any work in return. This, of course, is a condition not met in electric automobile service.

The cost per day for the two horses, wagon, driver, etc., necessary to accomplish thirty-six miles a day was found from Table IV, Section I, to be 428.54 cents. The cost of covering 11,268 miles will then be \$1,562.20. Here it must be remembered that 365 days have to be taken. The cost per car mile is then 13.86 cents.

When we come to consider the electric automobile for a year, covering thirty-six miles a day, its advantages are brought out very clearly. Since the vehicle, owing to the nature of its construction, does not consume any energy when not in motion, it follows that, during the periods of rest, while deliveries are being made and the wagon is being loaded, there is no more expense than that incidental to wear and tear. This, of course, is common in amount to all vehicles of the same class and may be considered the same in each case. That a slight loss does occur when the vehicle is at rest, due to local action, etc., in the batteries, is true, but this loss is considered when the efficiency of the battery is taken at eighty per cent. We may say then, that the factor most important in determining the expense of operating an electric vehicle is the price that must be paid for the power. This is a very variable factor indeed and the price per K. W. hour will determine in all cases the amount of saving that will be possible through the use of electric automobiles.

A stable taking power from a large central station would, if of average size, add a load which, if properly distributed as it easily could be, might become a considerable factor in straightening out the load curve of the station. If several stables were supplied from the same central station, this load

would become a great source of economy to the station, and power could be sold to them at a very low figure. Owing to the regular nature of the work imposed upon the wagons in delivery service it could easily be arranged to have the electric vehicles charged at night after the heavy load is off the station. They might also charge early in the morning and at noon or at periods that experience would indicate were the most advantageous for the station, the time of deliveries being adjusted to suit the new conditions. In this way a stable should be able to buy power at from one to two cents per K. W. hour. As this time has not yet arrived we will install for our purposes a small isolated gas engine plant. A plant of this kind should be able to produce a K. W. hour, at the switchboard for three cents. Assume the cost for a K. W. hour, as three cents, the power consumed per ton mile as 120 watt-hours and the weight as 3,500 pounds for the wagon. Taking the average load as 500 pounds, weight of driver as 150 pounds, and that of a boy as 125, the total weight is 4,275 pounds. The cost for the electric vehicle to cover 11,268 miles is given in Table XIV:

TABLE XIV.

1. Cost of power for 11,268 miles at 3 cents.....	\$108.35
a K. W. hour, and a consumption of 120 watt-hours per ton mile, total weight = 4,275 lbs., = 2,137 tons, watt-hours per car mile = 256.44, K. W. hours per 11,268 miles = 2889.57, taking efficiency of battery at 80 per cent. K. W. hours to be paid for = 3621	
2. Interest on cost of wagon at 6 per cent for year..	78.05
Cost of wagon, \$2,300.	
3. Interest on stable rent for one wagon for year....	34.28
4. Driver.....	625.68
5. Boy.....	416.83
Total cost per year.....	\$1,263.15
Cost per mile.....	11.21 cents.
Cost per ton mile.....	5.246
Cost of power per mile.....	.961
Cost of power per ton mile.....	.45

Hence the saving considering that the horse-drawn wagon does thirty-six miles a day six days a week, is 2.65 cents per car mile in favor of the electric vehicle which means a saving of 95.4 cents per day per wagon.

Owing to the greater speed of the electric vehicle, it takes only four hours to travel thirty-six miles as against 5.14 hours for the horse. This is a saving of 1.14 hours per day, or of 356 hours a year.

The figures given above speak for themselves and would appear to be a most effective argument in favor of adopting the electric automobile for delivery service.

SECTION IV.

CONCLUSION.

In light delivery service in large cities, when a number of units are employed by individual firms, the adoption of the automobile would seem to be merely a question of time. For this kind of service it seems pre-eminently the best solution. It is cheaper to operate than horse service, and the mechanical problems have been so far solved as to make the vehicles commercially successful. Though, as stated before, it is not the intention to discuss depreciation, it may be noted that the comparison of the costs of operation as regards food, cost of power, etc., would show a saving in favor of the electric delivery wagon, in one year of 20 per cent., which, under more

favorable conditions as to the price of power, might easily be increased. Assuming, for the moment, that the depreciation in a year is 25 per cent. for the electric system, and, under the same service conditions is only 10 per cent. for horse traction, we still have a saving of 5 per cent. in favor of the automobile. The advantages that will arise from the substitution of mechanical propulsion for horse traction on a large scale, are so well known and understood, that any extended consideration of the subject seems unnecessary. Among the many advantages, however, the following would seem to be the most important.

1. The hygienic condition of large cities will be improved, and the cost of street cleaning will be decreased.
2. The wear and tear on pavements and streets will be reduced, and the use of rubber tires will lessen the noise in the crowded streets.
3. The traffic in cities will not be as congested, owing to the saving in room now occupied by the horse. When we consider that there are approximately 200,000 horses used in New York City alone, and that a horse increases the length of a unit by nine feet, it can be readily appreciated how great a saving will be affected. Taking the average width occupied by a horse and shafts as two feet, it is seen that 200,000 horses occupy about 3,600,000 square feet, or 82.6 acres of valuable street room.
4. When the use of automobiles has become more general, the cost of operation will be reduced. This is true for the reason that with an increased output of wagons, the price will decrease, and with the greater use of power, the cost of it for this purpose will diminish.
5. The danger of accident from runaways will be eliminated.

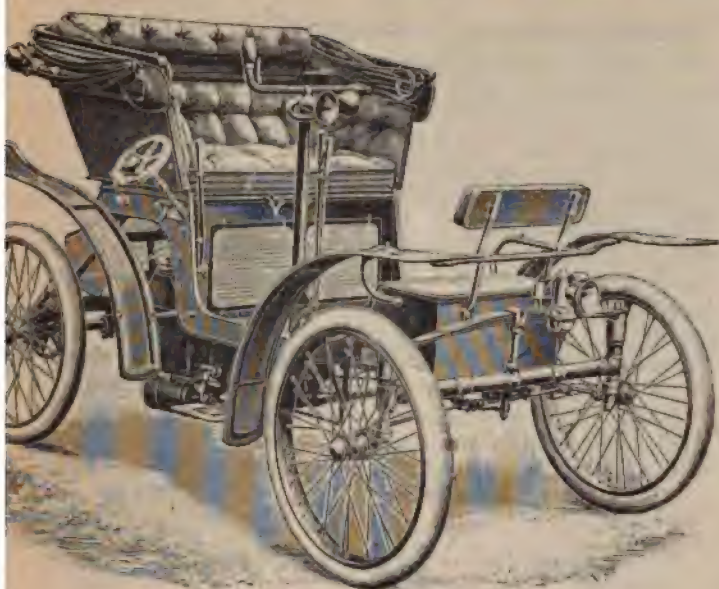
LONDON NOTES.

London, 29th June, 1899.

The Daimler Motor Co., Ltd., of London and Coventry, are preparing the drawings of a new type of gasoline delivery van capable of carrying a load of from 1 to 2 tons. Judging from the statements made at the meeting of shareholders this week this company is rapidly emerging from "a state of chaos" to more settled business lines.

NEW GERMAN MOTOR CARRIAGE.

The Motor Fahrzeug Gesellschaft, of Kaiser Wilhelm-strasse, 44a Dusseldorf, has lately introduced a new light motor carriage which appears to be built very much on the lines of the French Decauville carriage. The motor which works with petroleum is apparently of the De Dion type and is located in the rear portion of the vehicle, the cranks working in an aluminum oil-containing casing. The motor comprises two cylinders and is claimed to be capable of working up to 3 h.p. The ignition is electric, while the cylinders are cooled by means of radial ribs. Two oil storage tanks, in one of which the carburettor is contained are provided, their capacity being sufficient for a run of 90 miles. The ignition of the charge in each of the two cylinders is effected by means of a single cam, while the stopping and starting of the motor is controlled by the small hand-wheel on the right, within easy reach of the driver. Few details are available as to the transmission mechanism. It is stated, however, that no belts are employed, the power being transmitted through bevel gearing to the rear axle. Two mechanical speeds are provided, intermediary speeds being obtained by



NEW GERMAN MOTOR CARRIAGE.

advancing or retarding the ignition. A chest at the front, which also forms an additional seat for a child, contains the accumulators, the induction coil and a small lubricating oil tank. The frame of the carriage is built up of steel tubing, while the wheels are of the suspension type, 23 in. in diameter and shod with pneumatics. The steering is effected through a handlebar of the cycle type, on one branch of which a commutator is fixed to make or break the electric circuit and so control the motors. The overall length of the carriage is $7\frac{1}{2}$ ft., the width slightly under 4 ft. and the weight complete about 5 cwt. The Motor Fahrzeug Company is also making motor tricycles of the De Dion type and motor bicycles on the Werner system.

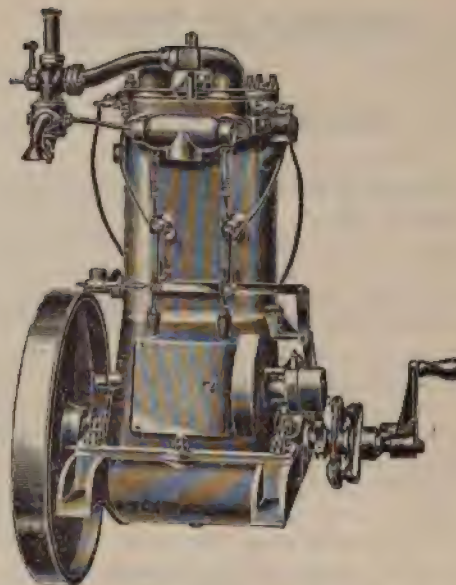
BELT TRANSMISSION.

There are now one or two motor carriages of continental build on the English market on which the transmission from the motor shaft to the counter-shaft is effected by means of belts normally running slack on the pulley, there being a different belt for each of the two or three speeds provided, the respective speed being put into gear by the tightening of the belt by means of a jockey pulley. Whether this arrangement is better than the system of fast and loose pulleys and the slipping of belts, as used in the Benz carriage, is now the subject of much discussion in motor circles here, both systems having, of course, their partisans. The opponents of the jockey pulley and slack belt system state that there is a great loss of power in it. Its supporters deny this and maintain that this is more than counterbalanced by the facility with which the speed may be changed, etc.

The German Daimler Co., the Daimler Motoren Gesellschaft of Cannstatt, Wurtemberg, reports a profit for the year ending March 1st, of \$14,003.

THE NAPIER GASOLINE MOTOR.

The new gasoline motor which has just been put on the market by D. Napier & Son, engineers, Lambeth, London, S. E., is of the vertical twin-cylinder type, and is claimed to be capable of working up to 7 b.h.p. at a normal speed of 780 revolutions per minute. Provision is made for the ready removal of the valves, it being only necessary to slacken two



NAPIER GASOLINE MOTOR.

screws and remove one bolt to withdraw them. A water-jacket is formed round the cylinders, the circulation being maintained by a small pump. The motor is started by means of a detachable crank handle, the operation being facilitated by a special device for raising the compression valve. The ignition is electrical, an ordinary form of sparking plug being employed. The carburettor used is of the Longuemare type, a device made and very extensively employed in France. The cranks work in an oil-containing case, ample provision being also made for the other working parts of the motor. A centrifugal governor is fitted on the motor shaft, this controlling a hit or miss device which cuts out one cylinder at a time. The Napier motor, including the carburettor pump and fly-wheel, is stated to weigh about 336 lbs.

INTOXICATED DRIVERS.

It is unfortunate for the motor vehicle movement here that two or three drivers of them have lately been summoned and fined for being drunk while in charge of vehicles. One case this week was at Dublin, where Messrs. Guinness, the well-known brewers, have lately started a Thornycroft steam wagon, the two men in charge of the vehicle being "found endeavoring to repair it on the road, but were so drunk as to be falling against each other." In the evidence the men stated that they had had only two drinks of porter. The magistrate apparently did not think Guinness' stout was so strong as this would indicate, but held they had had more than two drinks and imposed a fine. Joking apart, the question of the sobriety of motor-vehicle drivers is a serious one, and this has been recognized by at least one Scottish motor-car company which insists that all its drivers shall be teetotallers.

Public services of motor vehicles are now being started in the Austrian Alps, such services being about to be inaugurated between Meran and Trafoi, between Landeck and Trafoi and between Meran and Landeck. On the first named route a ten horse-power, fifteen-seated vehicle is to be employed; on the second a ten horse-power, twelve-seated one, with room for four to six passengers on the rear platform, and on the third a ten-seated motor bus.

COMMUNICATIONS.

Speed and Power.

College of the City of New York, July 14, 1899.

Editor Horseless Age:

Permit me to call attention to an apparent misunderstanding on the part of H. E. Dey. In the Horseless Age for July 5, W. H. Morrison asks for information concerning the following statement: "To increase the speed of a moving body, the power must be increased proportionally to the square of the speed, &c." To this Mr. Dey answers that Mr. Morrison has confounded air resistance with traction resistance. It is evident to me that Mr. Dey did not understand Mr. Morrison's difficulty.

To increase the speed of a moving body the energy must be increased proportionally to the square of the speed. In other words, the work to be performed is changed in that ratio, and not the power. If we disregard both traction and air resistance, the energy of a moving body measured in

foot-pounds is equal to $\frac{W \cdot V^2}{2g}$ where W = the weight of the moving body in pounds, V = the velocity in feet per second, and g = about 32 pounds. This is the energy which must be supplied. To produce double the velocity thus requires four times the energy, &c. The rate at which this energy is supplied determines the power.

Once acquired, the velocity would be maintained on a level road were it not for the air—and traction—resistances. If we assume the latter to be a constant quantity at all rates of speed, and if we disregard the air-resistance, then the energy supplied must be equal to the work done against this constant traction resistance, if the speed is to be maintained. The power required for this depends on the rate at which this work is performed, and equals the product of this constant resistance and the distance traveled in a unit of time. Hence the power required to maintain an acquired speed changes directly as this speed.

Now to increase a velocity to, say, double its amount will necessitate a total of $2 \times 2 = 4$ times the original energy, or $4 - 1 = 3$ times the original energy additional. This may be supplied at a slow rate or at a fast rate, the only difference being that it will take longer in the former case than in the latter to develop the required velocity. Hence the power may be almost any quantity over and above that necessary to maintain a speed, and the result will be an increased velocity, depending on the time during which the higher power is allowed to act.

WILLIAM FOX.

Mr. Woods Has a Name.

Chicago, Ill., July 6th, 1899.

Editor Horseless Age:

To self-propelled vehicles the name horseless carriage, automobile, motor vehicle, electric carriage, auto-car, electro-mobile, gasoline wagon, etc., cannot be used when speaking of the operator and retain the name of the vehicle, or distinguish the sex of the operator, or, in fact, distinguish the operator at all, let alone any distinction of

the act of running such a vehicle. What is required is a name that in speaking of an operator of either sex or the act of driving; will carry with it the name of the vehicle itself, and also a name broad enough in its application to apply to any form of self-propelled vehicle, whether electric, gasoline, steam or any other form of motive power.

The name I wish to suggest to the public is a name which fulfills all of these requirements and that is, the name autobaine, which translated means automatic wagon. Baine, being derived from an old Greek word, means wagon; so we have for the name of the vehicle, autobaine. Autobaineer, as applied to a man operator, autobaineeress, as applied to a woman operator, and autobaining or autobaineering for the act of using the vehicle, in addition to which this name is applicable to any kind or form of self-propelled vehicle.

I sincerely trust for your co-operation and adoption of this name. Thanking you in advance for same, I am, believe me,
Yours respectfully, C. E. WOODS.

Polycycle, "Syke" for Short.

Boston, Mass., July 10, 1899.

Editor Horseless Age:

I see in reading various articles concerning horseless carriages that there is some confusion and dissatisfaction because of the lack of a good name for the already-come vehicle.

The name of automobile (self moving), auto-car (self car), auto-vehicle (self carriage) seems to me very clumsy to say the least, and then they are words irregularly formed from the Greek and a modern language.

I think there is a very smoother word, wholly a Greek compound, which might be employed and would at once win its way and would at the same time correspond nicely with "bicycle" and in a similar way abbreviate or contract quite as successfully. The word is polycycle. The word bicycle (two wheel) abbreviates bicyc, "bike." The word polycycle (many wheels) might abbreviate, polycyc, poly, cyc (syke). The homelikeness of any one of these abbreviations seem too clear to need comment. Most respectfully submitted,

ROBERT W. MASON.

P. S.—There would then be a series: Unicycle, bicycle, tricycle and polycycle, respectively quite commensurate to their given spheres.

Overland from Kokomo to New York.

On July 17th, The Haynes-Apperson Co., Kokomo, Ind., started a wagon from their factory for New York overland, a distance of nearly 1,100 miles.

The route will be as follows: From Kokomo directly through Portland, Ind., Lima, O., Shelby and Cleveland. From Cleveland direct to Buffalo and Niagara Falls, through Rochester, Syracuse, Albany and directly down the Hudson River on the old Post road to New York. They expect to stop a day in Cleveland, probably a day in Buffalo, one day in Niagara Falls and one in Syracuse. They will make strictly a business trip, the carriage used being a standard doctor's phaeton, the property of Dr. A. A. Webber, of Brooklyn, N. Y., and will be delivered to the doctor on its arrival in Brooklyn. They will keep a direct account of running time and running expenses for the entire trip. Edgar Apperson will run the carriage and some other person will accompany him.

The Herald Trans-Continental Motor Carriage Tour.

The Duryea motor carriage, which is being sent across the continent by the New York Herald, left the Herald office a little after 11 o'clock last Thursday, accompanied by a large number of motor carriages and tricycles of French and American make, whose owners had gathered to act as escort to the tourists, Mr. and Mrs. Davis. Among the vehicles were several Riker electrics, the Decauville gasoline carriage and the gasoline tricycle of the American Motor Co., and a new carriage built by J. Frank Duryea, of Springfield, Mass.

Mr. Davis intends to proceed by easy stages at first to get the machinery in proper running order. At Cleveland, O., he will change his tires, putting on a set of the Diamond Flat-Tread Motor Pneumatics.

Tarrytown, N. Y., a distance of 37 miles, was reached in three hours and a quarter, the amount of gasoline consumed being two gallons. Here the tourists put up for the night.

On Friday the carriage made Poughkeepsie, 50 miles distant, the motor giving considerable trouble by the way owing to its newness, Mr. Davis said.

The journey from Poughkeepsie was resumed on Saturday, everything going well until north of Red Hook a stretch of road was encountered which was being repaired. As a road-bed large stones were thrown down promiscuously, to avoid which Mr. Davis turned aside into a side track of dirt. This, however, proved so soft that the vehicle nearly overturned, and to avoid this catastrophe Mr. Davis turned on all power and made for the roadside, breaking the pet cock and valve, the former of which had been out of order the previous day.

At Red Hook a roadmaster, who was also a constable, threatened to arrest the tourists because they were not preceded by an outrider to give warning of their approach. They were generally received with cordiality and even hospitality. Hudson, N. Y., was reached at 5 p. m. on Saturday, the odometer registering 57 miles from Poughkeepsie. Here the crippled motor was repaired.

The carriage encountered bad roads between Hudson and Albany, a heavy rain having fallen during the entire journey. Albany was not reached until nearly midnight Sunday. In addition to the slippery roads the tourists were detained by the loss of a nut from the exhaust valve of one of the cylinders, causing a delay of three hours.

Mr. and Mrs. Davis left Albany at two o'clock Monday and reached Amsterdam, a distance of 37 miles, at seven o'clock. Several stops were made by the way.

\$8,000,000 Contract Announced.

Isaac L. Rice, president of the Electric Vehicle Co., announces that he has placed with the Columbia & Electric Vehicle Co., of Hartford, Conn., orders for 4,200 electric vehicles, and that before the end of the year he expects the company will have nearly a thousand vehicles in operation by the different subsidiary companies in New York, Boston, Philadelphia and Chicago. The recent acquisition of the

plant of the New Haven Carriage Co., New Haven, Conn., will enable the Columbia & Electric Vehicle Co. to expedite the above order.

A writer in La Locomotion Automobile takes the ground that the motor vehicle exhibition at the Tuileries was too spectacular in its character, that too little attention was paid to mechanical features and too much to carriage work merely. In other words, he thinks the interior of the vehicles should have been more accessible to the public.

Philadelphia Automobile Club.

A movement is on foot to found an automobile club in Philadelphia. One of the first duties of the club will be to test the validity of the rule of the Park Commissioners excluding motor carriages from the Fairmount Park. Members of the Manheim, the Union League and the Mercantile Clubs are eager to be charter members.

MINOR MENTION.

The Auto Stage Co. has been organized at Chicago, Ill., with a capital of \$10,000.

The Geneva Wagon Co., Geneva, N. Y., is contemplating the manufacturing of motor carriages.

The Standard Novelty Co., Port Huron, Mich., is reported about to manufacture gasoline carriages.

It is reported that the Manitowoc (Wis.) Traction Co. has been organized to operate motor vehicles.

The C. H. Sieg Mfg. Co., Kenosha, Wis., will be reorganized and will begin the manufacture of automobiles.

The Franz Body Co., Akron, O., who have the contract to make bodies for the Winton Co., are enlarging their plant.

The Crouch Automobile Mfg. & Transportation Co., Baltimore, Md., are fitting up a plant at North avenue and Oak street.

It is said that a motor vehicle roadway is to be built from Cedar Lake to Chicago, Ill. Cedar Lake is a popular summer resort.

Martin Payne, a wagonmaker of Troy, N. Y., is applying gasoline motors to two delivery wagons belonging to local merchants.

The plant of the Elgin Sewing Machine and Bicycle Works, Elgin, Ill., long idle, will be started up soon to make motor vehicles.

The International Automobile Co., Albion Building, Boston, Mass., has been changed to the Strathmore Automobile Co. to distinguish it from the numerous other motor vehicle concerns employing the word international in their titles.

The Riker Electric Vehicle Co. started up their new factory at Elizabethport, N. J., last week, and by October 1st they expect to be turning out five vehicles a day, including all kinds, from the light runabout to the heavy truck. The plant, which is the old Lewis & Fowler car shop, covers three acres of ground.

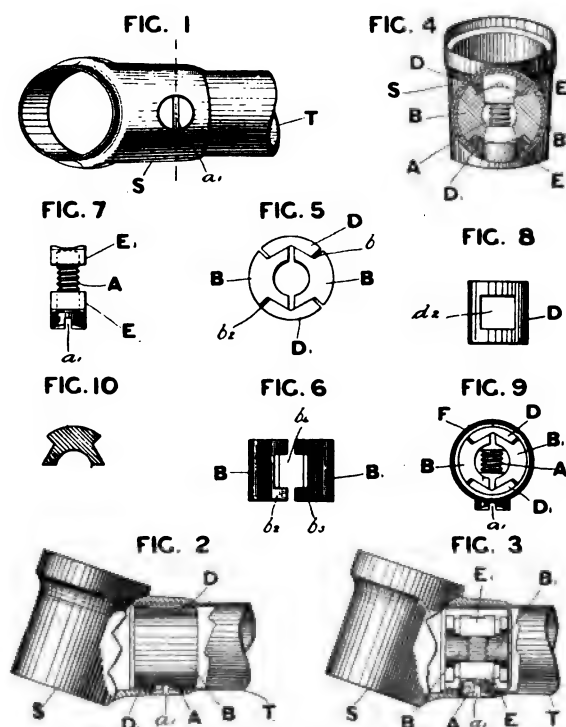
MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 628,476.—Junction of Cycle, Motor Car or Other Frames. Joseph Howard Kirk and John William Jeffs, Birmingham, England. Application filed March 18, 1898.

Figure 1 as an under side view showing the tube T connected to the socket S according to our invention. Fig. 2 is an elevation of Fig. 1 with a portion of the socket and the tube broken away. Fig. 3 is a similar view to Fig. 2, showing one of the drums or blocks removed. Fig. 4 is an end view of the socket and tube. Fig. 5 is an end view of the drums or blocks and other parts ready for inserting into the end of the tube. Fig. 6 is a plan view of Fig. 5 with the blocks D and D' removed. Fig. 7 shows the pin and wedge or cones. Fig. 8 is a plan view of the block D. Fig. 9 is an end view showing the parts held together by an outer sleeve or ferrule of soft metal. Fig. 10 is an end view of block B.



In carrying our invention into practice we bore the lug or socket S and turn the end of the tube T or spigot when necessary, so as to be a fairly accurate fit. We then bore a hole through the socket and through the tube, so as to allow the screw-pin A to pass through. We now form the four segmental blocks B and B' and D and D'. The blocks B and B' are preferably drawn in the bar, as shown at Fig. 10, and then cut off to the required lengths, which leaves them

in a nearly finished state, or these blocks may be formed by stamping, pressing, casting, turning, or the like, the center portion being formed hollow for lightness, if necessary. The blocks D and D' are fitted onto the inclined planes b' and b'' of the blocks B and B', and when the blocks B B' are slightly expanded they form the complete circle, as clearly shown at Figs. 4 and 5. Between the parts B and B' we form the holes b', which are tapered at each end toward the center to receive the tapered nuts E and E'. These tapered nuts have a hole drilled in the center, the hole in the nut E being sufficiently large so as to allow the screwed pin A to pass freely through; but the hole in the nut E' is tapped with a screw-thread to correspond with the screw-pin. The blocks D and D' are also provided with the hole d', so as to allow the nuts to pass freely through. When the parts are placed in position in the tube and the whole placed in position in the socket or lug, so as to bring the holes in the tube and socket exactly over each other, the pin A is inserted and screwed up by inserting the end of a suitable tool in the slot a', formed in the head of the screw-pin, the point of the screw-pin, which fits into the tapered nut E', will draw this nut inward, and the other tapered nut E will be forced inward also by the under side of the head of the pin, by which means the two semi-blocks B and B' are opened out, which action at the same time causes the blocks D and D' to expand also, thereby strongly forcing the parts B and B' and D and D' against the inner surface of the tube, thus expanding or tightening it in the socket or lug and forming the junction without brazing. Instead of using tapered nuts we may use conical nuts, and in this case one nut may be formed solid with the pin. After the pin A has been screwed home, which is then flush or nearly flush with the surface of the lug, a spring cap or cover may be used for covering the end of the pin.

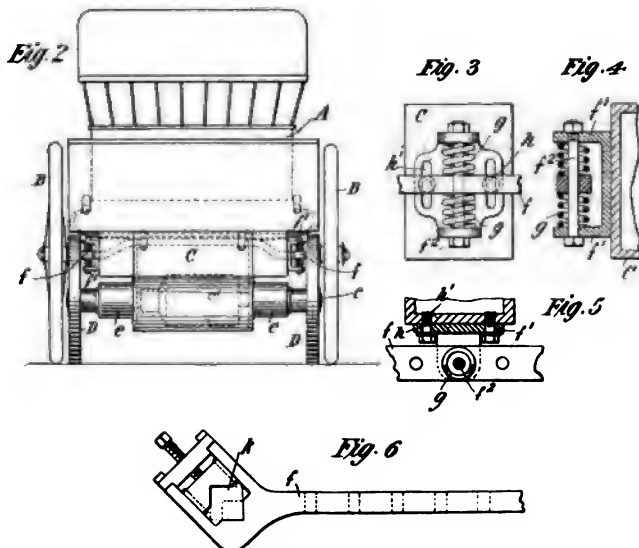
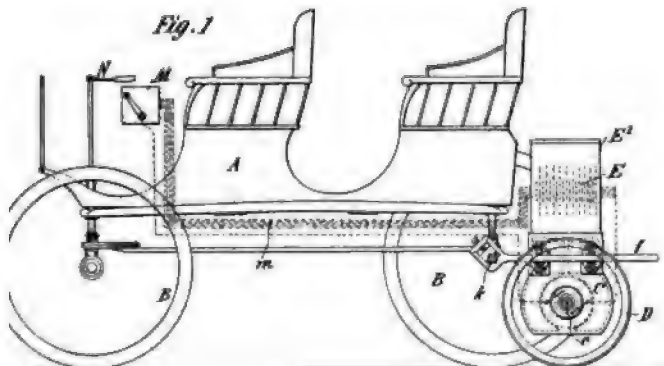
For the purpose of holding the parts together while they are placed in the tube and for storage purposes we fit them into the short piece of soft-metal tubing F, as shown at Fig. 9, and this tube may be placed with the parts into the end of the tube T when forming the junction, and when the semi-blocks and parts D and D' are expanded this tube, being of a soft metal, will expand also, thus forming a kind of pad or cushion between the two hard surfaces. It will be evident that the semi-blocks and the parts D and D' may, when fitted together, be of any form in cross-section—such, for instance, as oval, D shape, square, or octagonal—so as to enable the junctions to be made with tubing of a like shape or section.

No. 628,514.—Electric Vehicle.—William F. Zimmermann, East Orange, N. J. Application filed May 12, 1899.

The general purpose of this invention is to provide a propelling device which is separable from the vehicle and adapted to be transferred from one vehicle to another, as occasion may require.

In the accompanying drawings, Figure 1 is a side elevation of a vehicle and a propelling device temporarily attached thereto. Fig. 2 is an end view thereof. Figs. 3, 4, 5 and 6 illustrate details.

A represents the body of a vehicle of any suitable character, and B B represent the supporting-wheels thereof. The propelling device consists of an electric motor C of any suitable character, mounted upon the axle c of the traction-wheels D. These traction-wheels are constructed in any suitable manner to afford the necessary friction with the ground. A storage battery or other suitable source of electric current E is carried within a suitable compartment E'. In the drawings I have shown the field-magnet c' of the electric motor



as being carried by boxes *e* and the compartment *E* as supported upon the field-magnets. Various modifications in the method of supporting these several parts may be employed without departing from the spirit of my invention.

For the purpose of conveniently attaching and removing the propelling device coupling-bars *f* may be employed. These are shown as being carried by lugs *f'*, secured to the sides of the field-magnet, and bolts *f''* pass through the rods and through the lugs. For conveniently adjusting the distance of the propelling device from the vehicle the bars *f* are provided with additional holes, as shown in dotted lines in Fig. 6. In the drawings I have shown cushioning-springs *g* above and below the bars *f* for the purpose of permitting a relative movement on the part of the vehicle and the propelling device. Vertical adjustment of the bars *f* may be had by means of the slots *h*, as shown in Fig. 3, the bolts *h'* passing through these slots and fastening the lugs *f'* to the field-magnet, so that the extensions themselves may be adjusted.

The bars *f* are coupled to the rear axle of the vehicle by any suitable form of clamp—such, for instance, as is shown in the drawings at *k*—and they may be readily removed when it is desired to use the propelling device in connection with another vehicle. The form and structure of the clamp may be modified according to requirements of different vehicles.

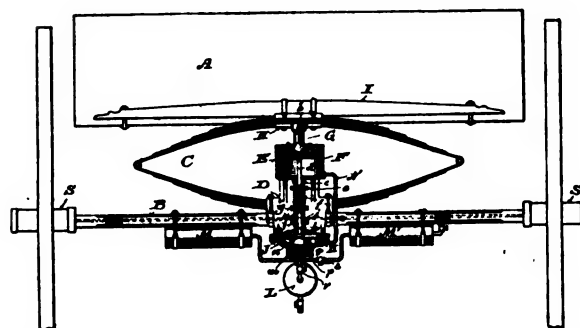
The length of the axle *c* is usually such that the traction-wheels *D* may pass within the tread of the rear wheels of the vehicle. This makes it possible to bring the propelling device in close proximity to the vehicle. The weight of the storage

battery and the motor being carried almost entirely by the traction-wheels *D*, the necessary friction is claimed.

No. 628,727.—Compressed Air Mechanism for Vehicles.—Ferdinand Schumacher, Iron Ridge, Wis. Application filed September 6, 1898.

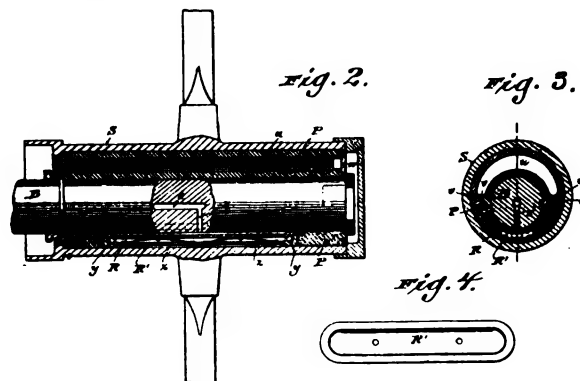
Figure 1 represents a sectional front elevation. Fig. 2, a detail sectional view illustrating a portion of a vehicle-axle, a wheel-hub thereon, and means for the application of compressed air to reduce friction; Fig. 3, a transverse section of the assemblage shown in the preceding figure, and Fig. 4, a plan view of an expansible bearing-block section inverted.

Fig. 1.



A represents a vehicle-body; *B*, an axle of its running-gear; *C*, an interposed elliptic spring, and *D*, a casting that is clipped with the spring to the axle.

Constituting part of the casting *D* is a pot *E*, containing an air-tight piston *F*, and a rod *G*, in ball-and-socket-joint connection with the piston, has adjustable screw-thread connection with the central socket portion *b* of a stay-plate *H*, clipped with the spring *C* to a body-bar *I* of the vehicle. Depending from the piston through a stuffing box *c*, central of the pot-bottom, is a screw-threaded stem *d*, and a flanged nut *e*, adjustable on this stem, is opposed to a spiral spring *f*, seated on another flanged nut *g*, adjustable on a screw-threaded plunger *h*, that extends down through an externally-screw-threaded sleeve *i*, rising from the center of the upper half of a casing *J*, containing an expansible diaphragm *K*, the sleeve being engaged by a nut *j*, that constitutes a seat for another spiral spring *k*, opposed by the nut *g* aforesaid, this latter spring being at all times of less tension than the one aforesaid.



The upper half of the diaphragm-casing constitutes part of the casting aforesaid, and the lower half of said casing, bolted in place, is provided with an inlet-port and an outlet-

port governed by spring-controlled valves. The valve m, governing the inlet-port, opens downward against the spring surrounding its stem, and the latter is opposed by a boss n, depending from the expansible diaphragm. The valve p, governing the exhaust-port, has the upper end of its stem headed within a cup q on the under side of the diaphragm. Therefore lift of the diaphragm will unseat the latter valve against resistance of the spring surrounding its stem.

The inlet-port of the diaphragm-casing has pipe connection with a storage-reservoir L for a supply of compressed air, and this pipe connection is governed by a cock r, that serves to regulate or cut off the flow of said air to said casing.

Auxiliary air-chambers M M', suspended from axle B, have pipe connection with each other, and by means of a cock s one of these chambers may be cut off from the other. The chamber M' has cock-controlled pipe communication with an air-passage t, longitudinally of the axle B, and this air-passage is also in communication with a pipe N, connecting the lower portion of diaphragm-casing J with the pot E aforesaid.

Held loose on each end of the axle, eccentric thereto, is a cylindrical shell P, provided with a longitudinal lubricant-chamber u, having distributing ports v, the inlet-port of this chamber being closed by a rotarily-adjustable slide w. (Shown in Fig. 2.) A recessed portion of shell P is engaged by an expansible bearing-block comprising intermatching sections R R', interposed springs x, and yielding packing y, the latter serving to make the joints of said block air-tight. Externally the faces of the bearing-block sections are recessed to provide inner and outer air-spaces respectively adjacent to the axle and a wheel-hub S, loose on the shell P, said axle and wheel-hub being lubricated by material escaping through the ports v of said shell.

A port z leads from the air-passage in the axle into the inner air-space between said axle and expansible bearing-block, and the sections of this block are apertured, so as to provide for flow of air between the same, as well as into the space between said block and the wheel-hub. The area between sections of the bearing-block being greater than that in the inner and outer spaces adjacent thereto, the pressure exerted will hold the sections of said block snug against the axle and wheel-hub when the compressed air is on, and the latter being off the springs x, under tension between the block-sections, compensate for wear. Therefore there is always air-tight opposition of said block to said axle and hub.

In practice the volume of compressed air in pot E and one or both auxiliary chambers M M' in communication with said pot exerts pressure in the air-spaces in and about the expansible bearing-block above specified, this pressure being automatically governed in proportion to load in order to reduce friction intermediate of the axle and wheels.

Assuming that piston F is in the position shown in Fig. 1, under normal load, increase of load will cause descent of said piston to compress the air intermediate of this piston and the wheel-hubs, the compression being proportioned so that lifting pressure within the recesses of the expansible bearing block sections R R' will compensate for friction that would otherwise come upon the axle and said wheel-hubs, the rate of compression being regulated by adjustment of air-cock s and the piston-rod G in socket b, as well as by adjustment of nut e in some instances. The automatic air compression will take place, whether downward movement of piston F be fast or slow, without affecting valve m, con-

trolling inlet from the reservoir L; but should the pressure become too low from any cause—such, for instance, as unavoidable leakage of air incidental to travel of the vehicle—the tension of spring f will overcome the combined force of the reduced pressure below diaphragm K and resistance of spring k, whereby plunger h will be exerted on said diaphragm to unseat said valve, thus permitting inflow of enough compressed air from said reservoir to obtain the proper degree of pressure in and about the expansible bearing-block.

If at any time air-pressure in and about the expansible bearing block is too high, the nut j is run up to increase tension of spring k, and the latter, with the pressure below diaphragm K, will operate to overcome spring f, whereby said diaphragm will be lifted to elevate valve p, and thus permit escape of air until said pressure and tension of the former spring counterbalance with the tension of the other or stronger spring, whereupon the exhaust-valve is again seated.

The auxiliary chambers M M' are only employed when it is not convenient to make the pot E of sufficient area for the necessary volume of air opposed to descent of piston G in said pot, as well as in and about the expansible bearing-block. Hence provision is had for cutting off one or all of said chambers from automatically-governed air-supply.

Owing to the air-spaces provided adjacent to the axle and wheel-hub the frictional area is proportionally lessened, and the pressure exerted by the air being proportioned to variations of load there is compensation for all the friction that would otherwise result.

Each shell P being eccentric to the axle upon which it is held, it will yield incidental to shock caused by obstructions in the path of the vehicle-wheel, to which it is relative, or to ascent and descent of road-grade, thereby causing the expansible bearing-block and air chamber or recess containing same to come directly opposite the line of pressure resultant between the draft and load; but the resistance being overcome said shell will by gravity automatically return to normal position.

In practice the upper recess or air-space in the expansible bearing block is of such width that it does not get out of register with the port z in the axle incidental to the yield of shell P to shock or inclination of road upon which the vehicle travels.

While I have only shown my improvements in connection with the forward spring and axle of the vehicle, they are duplicated in connection with the rear spring and axle.

Ordinarily load-pressure will cause an axle to press against the inner lower surface of wheel-hubs thereon. Therefore rotation of these hubs results in considerable friction. To obviate this friction as a result of load-pressure, it will be understood from the foregoing that a volume of compressed air is interposed between the inner lower surface of each wheel-hub and its axle, the pressure of this compressed air being so regulated with respect to all load variations that it counteracts load-pressure on said axle without forcing the latter against the upper inner surface of the hub.

No. 628,755.—Wheel for Vehicles. Henry Campkin, Nottingham, England. Application filed February 14, 1898.

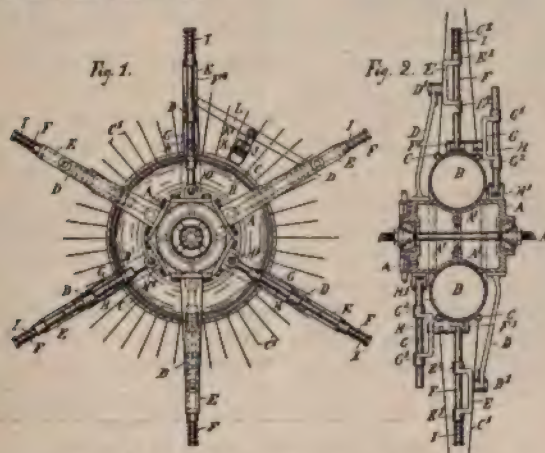
Fig. 1 is a side elevation, and Fig. 2 a vertical cross-section, showing the middle part of a wheel constructed according to the invention.

According to this invention in a pneumatic wheel the hub A, which is mounted on an axle A' in the usual manner,

is formed with an annular seat A' , on which is mounted a flexible annular air-chamber B . This air-chamber may be formed of india-rubber strengthened with canvas or other material and may be provided with an inflation-valve of any well-known form or be inflated in the manner hereinafter described.

In the drawings the hub A is shown divided in the middle in order that the air-chamber B may be placed in position; but if the seating A' were formed in an enlarged portion of the middle of the hub instead of as shown the air-chamber could be sprung into position and the hub in this case be formed in one piece.

Mounted on the periphery of the annular air-chamber B , and thus inclosing it, is a rim C of suitable section. This rim C is connected to the outer rim of the wheel by spokes C' , disposed in any well-known manner. The outer rim of the wheel (which is not shown in the drawings) is concentric with the rim C and may be provided with a solid or pneumatic tire, as preferred.



Up to this point the wheel described may be said to be similar to wheels of well-known construction, and I will now proceed to describe those parts which comprise the main feature of my invention.

On each side of the hub A are three or any other convenient number of radial arms D . These arms D may be secured to or formed integrally with the hub and are so distributed that those on one side alternate with those on the other side, as shown. Pivoted in the outer end D' of each radial arm on an axis at right angles to the plane of rotation of the wheel is a bracket E , provided with guideways E' E'' , in which latter is mounted a pin F . These pins F can slide longitudinally in their respective guideways E' E'' . The inner ends of these pins F are pivoted to the rim C at F' , also on an axis at right angles to the plane of rotation of the wheel. When the rim C and the outer part of the wheel are moved into an eccentric position relatively to the hub A , the pins F will either slide in the guideways E' E'' of the brackets E or said brackets E and pins F will oscillate about their respective pivots D' F' , or both movements may occur in one set, according to the position they for the time occupy relatively to the eccentricity of the rim C and outer part of the wheel with the hub A . The arrangement will thus offer no resistance to the outer part of the wheel moving into an eccentric position relatively to the hub, but will, however, hold or maintain the outer part of the wheel rigidly parallel to its plane of rotation.

Pivoted to the rim C , opposite to each of the radial arms D of the arrangement previously described and preferably on the same pivot F' as the pins F , are a corresponding number of brackets G , provided with guideways G' G'' . Mounted in the guideways G' G'' of each bracket G is a pin H , the whole of which are pivoted at their inner ends to the hub A or brackets H' secured thereto. This arrangement works in precisely the same manner as the arrangement previously described.

The arrangement described has in some cases to perform another office—that is, communicate the driving power from the hub to the outer part of the wheel.

In order to prevent undue oscillation of the pivoted brackets E and G , owing to the driving power being communicated from the hub A to the rim C and outer part of the wheel through the pins F H and said brackets or from other causes the inner guideways E' G' on each bracket are placed nearer to their respective pivots D' F' than the outer guideways E'' G'' , and it will thus be seen that when the brackets oscillate the inner guideways E' G' will move through a shorter radius than the outer guideways E'' G'' , and the resistance to further movements will thus be gradually increased up to a certain point, beyond which they will not move.

In order to assist the pneumatic air-chamber A , springs I may be placed on the pins F between the brackets E and the outer ends of said pins. By employing springs I of sufficient strength the pneumatic chamber B may be dispensed with and the whole of the resiliency obtained from the said springs, thus constituting it a spring wheel.

In order to automatically inflate or maintain the air in the air-chamber B at a constant pressure, one or more pumps may be employed and be disposed as follows: The barrel J of each pump (see Fig. 1) is secured to the rim C , and said barrel is connected to the interior of the air-chamber by a pipe provided with a non-return valve. The piston K is connected by a link K' to a rigid stay or bar L , extending from one radial arm D to the next arm D on the opposite side of the hub.

AUSTRALIAN PATENTS.

From Phillips, Ormonde & Co., Patent and Trade Mark Agents, 533 Collins Street, Melbourne, Victoria, who are in possession of further information.

"SPEED VARYING DEVICES AND ELECTRIC MOTORS FOR USE THEREIN." R. H. Hassler, of 536 Illinois Street, North, Indianapolis, Ind., U. S. A., 3d May, 1899. No. 16,132. In the Colony of Victoria.

"RELATING TO APPARATUS FOR CONTROLLING AND GOVERNING ELECTRIC MOTORS." H. P. Davis, of 327 Neville Street, Pittsburg, in the County of Allegheny and State of Pennsylvania, U. S. A. 3d May, 1899. No. 16,133. In the Colony of Victoria.

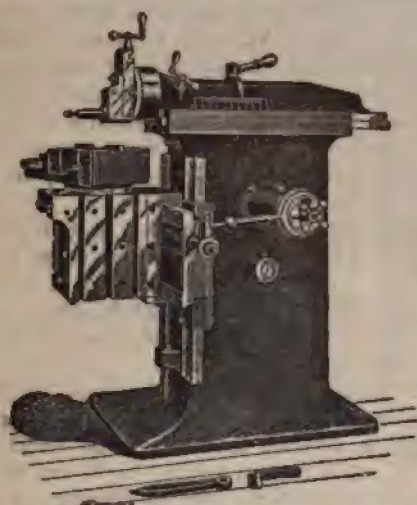
"POSITIONING APPARATUS FOR MOTOR VEHICLES." G. H. Condict, of 1684 Broadway, New York, in the County and State of New York, U. S. A. 4th May, 1899. No. 16,135. In the Colony of Victoria.

"MOTOR, DRIVING AND CONTROLLING MECHANISM OF POWER PROPELLED VEHICLES AND CONSTRUCTION OF SUCH VEHICLES." J. Pender, of Tinning Street, Brunswick, Victoria, 31st May, 1899. No. 16,219. In the Colony of Victoria.

"PNEUMATIC VALVE PRINCIPALLY APPLICABLE TO TIRES." R. W. Henn, of Princes Street, Hawera, New Zealand, 4th April, 1899. No. 11,509. In the Colony of New Zealand.

"ELASTIC TIRES AND RIMS FOR WHEELS." W. F. Williams, of 17 and 18 Great Pulteney Street, Golden Square, London W., England, 15th April, 1899. No. 11,537. In the Colony of New Zealand.

"DEVICE FOR LOCKING THE WHEELS OF BICYCLES AND SIMILAR VEHICLES." W. Morris, of 183 Hereford Street, Christchurch, New Zealand, 25th April, 1899. No. 11,568. In the Colony of New Zealand.



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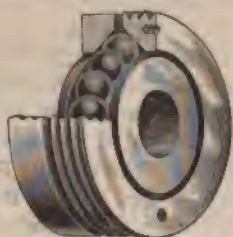
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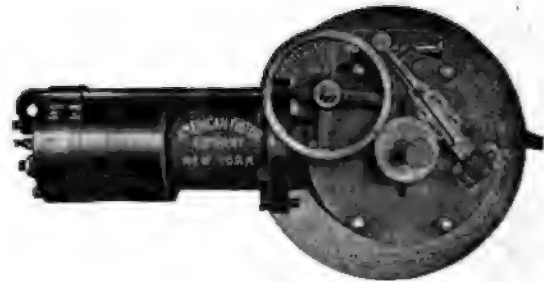
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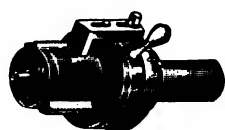
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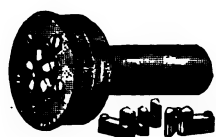
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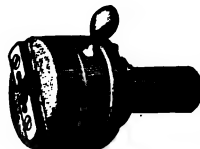
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DEVOTED TO MOTOR INTERESTS

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THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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The Voiturette.

All accounts of the Paris Exposition agree in awarding the palm of popularity this year to the voiturette, or light petroleum carriage for two persons. Owing to the headlong impetuosity with which the French nation plunged into road racing, the manufacturers have been developing heavy machines fitted for the highest speeds over long distances. The high-powered motors and extra weight and strength required for machines of this kind raised prices above the means of the average buyer and made the motor pleasure carriage an appurtenance of the rich or of the professional racer. But as the industry progressed the pressure upon the manufacturers from the great middle class of buyers finally became so strong that they were compelled to heed it, scarcely knowing, it seems, that in supplying this and the strictly commercial needs lay the future of their industry. Last year

a few carriages of the voiturette type were seen at the exhibition; this year the number was so much larger and the interest in them so marked, that the makers now realize that in this branch of development at least there can be no doubt of profitable trade. The voiturette is the machine for ordinary light service as distinguished from the ponderous racer and the luxurious vehicles for touring, which are provided with every convenience and comfort, and must be of strong and heavy construction. It is the runabout, the sociable, adapted to runs of 25 or 50 miles in and around cities and towns, where speed is limited and roads are good. In short, it is suited to the wants of the ordinary user under ordinary conditions.

In our own country the same tendencies are working, though much more strongly than in France. Road races do not appeal to the American people as they do to the French; nor, if they should be introduced here, will our authorities long consent to such an abuse of the highways. With our more practical bent the commercial phases of the problem will prove most attractive to our manufacturers. High-speed carriages and racing machines we will surely have, but their production will constitute a very small part of the great industry that is destined to grow up on our soil.

In endeavoring to analyze and supply the general demand, however, there is one difficulty besetting the American manufacturer from which his French coworker is entirely free, and that is our rough roads, which necessitate a heavier and stronger construction than would answer for ordinary conditions in France. While the majority of prospective buyers in America wish a light machine at a reasonable price our roads both in city and suburbs are so generally bad that the light voiturette of the French type is of very limited radius here. Our manufacturer is embarrassed by the fact that so many of his prospective customers want a light carriage suited to both ordinary and extraordinary conditions, i. e., to both good and bad roads, a contradiction which cannot be satisfactorily met by one and the same machine.

Later, when the public are educated up to the limitations of the different types of machines and the limitations of American roads the task of our manufacturers will be easier, but in the present initial and unsettled state of the industry the problem of the pleasure carriage is particularly puzzling.

One Controlling Lever or Two.

The supreme importance of the controlling apparatus of a motor vehicle is just beginning to be appreciated. The racing mania has a tendency to centre attention too much on mere power and its resultant speed, and to minimize control which in the vehicle for ordinary services is of vital consequence.

At the present moment our inventors and manufacturers differ in regard to the number of levers which are used to control their vehicles. Some employ but one lever for steering and regulation of speed, claiming that this simplifies operations and enables the hand to respond at once to the brain. Among the advocates of this system of control is Mr. Sperry, who, in his paper read before the American Society of Electrical Engineers, likens the motor vehicle to the trolley, in which the controlling operations are all performed with one handle. Other manufacturers who employed only one controlling lever on their first vehicles have changed to two levers, on the ground that their experience proved to them that it was not wise to give one hand too many things to do, for fear that the brain might be confused at critical moments. In France, where sufficient time has elapsed to render testimony on this point of real value, two levers are quite generally the rule. The mechanical brake, of course, is not included in this discussion, for it is always operated by a pedal convenient to the foot.

With reference to Mr. Sperry's comparison of the trolley and the motor vehicle there is one striking difference, which of itself is enough to entitle the motor vehicle to a separate classification. We refer to steering. The trolley is confined to a track; the motor vehicle has the liberty of the road. If, therefore, the control of a motor vehicle involves another function of such prime importance as steering, does the analogy of the trolley hold good? Is not the separation of these two chief functions of the motor vehicle necessary for the proper performance of each, in accordance with the law of specialization?

The Motor Tire.

The majority of the pneumatic tire manufacturers of the country are making little effort to supply the needs of motor vehicle manufacturers. The problem of the motor pneumatic is by no means an easy one. The excessive weights which must be carried and the increased strains to which the tire

is subjected because of this weight and the four-wheeled construction, render a long series of experiments necessary before its solution can be approached. One of the chief difficulties seems to be to secure sufficient toughness and strength in the tread without sacrificing too much of the resiliency, although the latter quality is accounted of less consequence than in the bicycle.

Several manufacturers of electric vehicles are putting solid tires on their delivery wagons and coaches and pneumatics on their lighter pleasure carriages. On the other hand at least one brand of motor pneumatics, made for this service, is known to be carrying weights of a ton and a half to two tons quite successfully. The inference seems to be, therefore, that the pneumatic tire makers, generally speaking, have failed to make a study of the requirements of this new service, and have been content to offer tires made virtually on the bicycle principle but of larger diameter.

There is another point of supreme importance to the manufacturer and user of a motor vehicle, namely, the durability of the vehicle as distinguished from the durability of the tire. Of two tires, one may be shorter lived than the other and still be the more economical because it increases the life of the whole vehicle by relieving it of shocks and strains. In any comparison which may be drawn between the pneumatic and the solid tire this fact must be borne in mind if correct conclusions are to be reached. For a satisfactory test of this nature, time is essential and time is what the average motor vehicle inventor is unwilling to give. He is too apt to judge hastily and on insufficient practice, or to confine his attention to one side of the subject and ignore the other.

"Stunts."

W. H. Vanderbilt, Jr., was doing "stunts" with his electric carriage the other day at Newport, when he took a somersault, carriage and all, badly damaging the vehicle and giving himself a severe shaking up. The particular kind of "stunts" or feats of daring which he was trying to do have not been explained, but he was probably backing down hill, when he stopped too suddenly, reversing the current at the same time. The effect was to send the heavy machine over backwards like a shot, burying the young millionaire underneath.

It is useless to offer any further advice in regard to fast driving and the doing of "stunts." Foolhardy and thoughtless persons will continue to be guilty of both, and deaths from these causes are bound to occur occasionally, but there is one lesson which motor vehicle manufacturers are having every opportunity to learn, and that is that the high motor vehicle is merely a thoughtless imitation of the horse vehicle, dangerous from every point of view, unfit for anything but smooth roads and slow speeds.

THE MOTOR-CAR JOURNAL'S EXHIBITION.

(From our own correspondent.)

London, July 6, 1899.

The motor-car exhibition opened at the Agricultural Hall, Islington, on Monday last; although all the exhibitors have not yet put in an appearance, it is much larger and decidedly more interesting from the point of view of new types of carriages than the automobile show at Richmond a fortnight ago. Naturally, a good many of the vehicles displayed are similar to those seen at the previous show, so that I shall only briefly mention the names of those exhibitors, reserving the space for a description of the new vehicles. Dealing first with

STEAM VEHICLES.

Five different types are shown. The Steam Carriage and Wagon Co., Ltd. of Homefield, Chiswick, London, W., exhibit wagons on Thornycroft's system. At the recent trials at Richmond a vehicle of this type maintained an average speed of 5.4 miles an hour, over a 20-mile course, at an average expenditure for fuel of 1.055d. per mile.

The Liquid Fuel Engineering Co., of East Cowes, Isle of Wight, again have on view the large steam bus they constructed for service in France, and also exhibit their 14-seated steam waggonette and a steam lorry to carry from four to five tons.

Stirling's Motor Carriages, Ltd., of Hamilton, N. B., are also showing for the first time in London the 20-seated omnibus they have lately built. The engine, boiler and transmission of this vehicle are the production of the Lancashire Steam Motor Co., of Leyland. The boiler is oil-fired and works at a steam pressure of 200 lbs. The engines are of the vertical two-cylinder type, capable of working up to 8 h.p. Three forward speeds and one backward motion are provided, both the countershaft and the rear wheels being driven by Renold "silent" chains. The weight of the bus complete with 26 gallons of water and 18 gallons of oil, is 2 tons 8 cwt. The bus has already been driven about 500 miles in Scotland.

Messrs. Bayleys, Ltd., of Newington Causeway, Southwark, S. E., exhibit the steam lorry which took part in the recent trials, a tip-wagon body having been in the meantime substituted.

C. T. Crowden, of the Motor Works, Leamington, exhibits a steam brake. The vehicle has been designed and made entirely for experimental purposes, to ascertain what advantages a steam vehicle possesses over a petroleum one, and also the h.p. most suitable for the work. The carriage at present is not fitted with change speed gear, but, having a vertical compound engine, it will travel at a very high speed on the level, up inclines and steep hills. The frame is entirely of steel, with laminated steel springs, and long bolted, mail-pattern axles, Crowden's wheels with oak spokes, ash felloes, and rubber tires. The boiler is of the multitubular type, constructed to burn coke or oil, and fitted with improved automatic stoking arrangement. The engine is of the compound type, fitted with link motion and an intercepting valve by which high pressure steam can be used in the low pressure cylinder for starting and for climbing steep hills. The carriage is fitted with a foot brake acting on a drum on the differential gear shaft, and a screw lever brake acting on both hind wheels, and both of these can be actuated from the driver's seat. The



CROWDEN STEAM BRAKE.

counter-shaft is driven by spur wheels, while chain gearing connects the counter-shaft with the rear wheels.

GASOLINE VEHICLES.

Gasoline vehicles form, of course, the great bulk of the exhibits. The Daimler Motor Co., of Coventry, have four of their vehicles on view. The Motor Mfg. Co., Ltd., of Coventry, have a large display which is very much the same as that at Richmond. The "Princess" two-seated carriage has, however, lately been considerably modified. The motor is of the two-cylinder horizontal type of $4\frac{1}{4}$ h.p., with tube ignition and water-jacket. The power is transmitted from the motor-shaft to the counter-shaft by spur wheels and from the latter to the rear axle by a central single chain drive, a jockey-pulley arrangement being provided to secure the proper tension of the chain, which is of a larger type than in the first carriage. Three forward speeds and two reverse motions are provided, while a special feature is the provision of a governing device by means of which when the carriage is at rest the motor may be kept in motion but slowed down to the extent of but one explosion per second. The normal speed of the motor is 750 revolutions, but this can be increased to 1,100, giving a maximum speed of 23 miles an hour. Another feature of the carriage is to be found in the suspension; not only is the body supported on the frame by helical and C springs, but the frame is also supported on the axle through the medium of helical springs. The bearings of the axles are also carried in a box which is free to slide up and down in the support, provision being thus made for the taking up of any strain very much in the same way as is done in locomotives. Another new feature is the provision of a sleeve to, and entirely covering, the rear axle. The vehicle, which weighs complete only 8 $\frac{3}{4}$ cwt., is provided with a detachable splashboard, in place of which a small additional front seat can quickly be fitted, while instead of a front seat a rear one can be attached if desired.

The largest gasoline vehicle in the show is the 26-seated omnibus shown by Bayleys, Ltd., Southwark, S. E. The

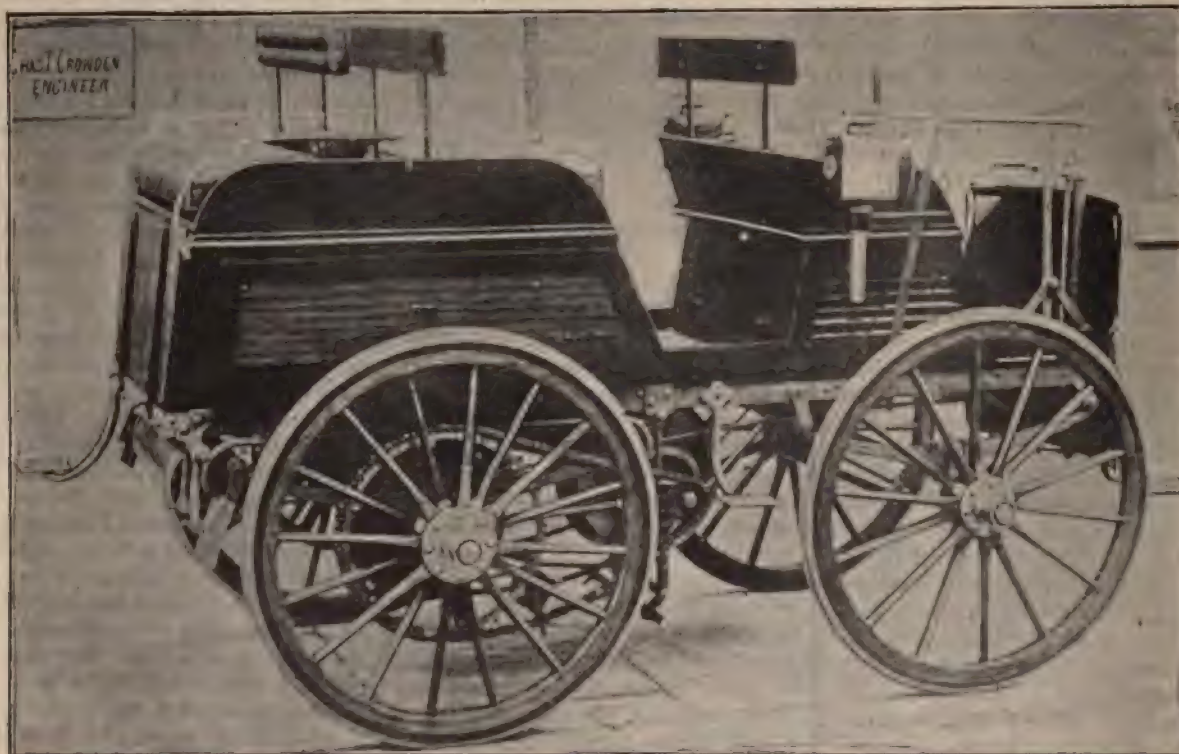


BAYLEY'S PETROLEUM SPIRIT MOTOR OMNIBUS.

body of the vehicle is similar to the 'buses used in London, but is mounted on a channel-iron frame, to which the motor and transmission gear is mounted. The motor which is located in front is on the Panhard system, comprises four cylinders, and is stated to be capable of working up to 12 h.p. The power is transmitted through bevel gearing to a counter-shaft at the rear, and from the latter to the rear wheels through pinions gearing with internal-toothed rings bolted to the wheels. Three forward speeds ranging from five miles up to 14 per hour, and one backward motion are provided. Steering is effected through the front wheels by means of a hand wheel. Three brakes are provided, two band brakes acting on the hubs of the rear road wheels, and a band brake

working on a drum on the motor-shaft, which is automatically applied by the throwing out of the friction clutch.

C. T. Crowden, of the Motor Works, Leamington, exhibits a four-wheeled dog cart, propelled by a gasoline motor. The vehicle has seating accommodation for six persons when carrying a full load, four persons facing the direction of progression and two facing towards the rear. The whole of the controlling and steering apparatus is placed on the right hand of the driver's seat. The motor is of 10 h.p. effective, and is of the twin-cylinder horizontal type. The cylinders are not provided with water-cooling chambers, but the whole of their length is inserted through a large wrought copper tank in such a way that the cylinders are closely in contact with the metal of the tank, and consequently completely surrounded by an envelope of water of considerable depth. The motor is carried at the rear of the vehicle, well off the ground, and above the main frame. The fly-wheel is central with the centre of the carriage, and rotates in the same direction as the vehicle travels. The engine is so constructed that, at the desire of the driver, either cylinder can be shut out of action, it being claimed that one cylinder furnishes sufficient power to propel the vehicle over fair roads at ordinary speeds. Three forward speeds and one reverse motion are provided, the power from the motor-shaft being transmitted to the counter-shaft by belts which, normally running slack, are tightened by jockey pulleys. From the counter-shaft to the rear wheels chain gearing transmits the power. Electric ignition is employed, current being supplied to the coil from secondary batteries. The wheels of the carriage are of peculiar construction. They are of the gun-carriage type, the spokes being double dished. Increased stability is insured by the fact that in wheels of this type double the width of stock is secured. The chain wheels, or sprockets, instead of being bolted to the spokes of the wheel, as is generally the



CROWDEN'S FOUR-WHEELED DOG CART.

case, are bolted to a flange on the hub. By this means it is assured that the hub and chain will always run true with the axle, which is not the case when the sprockets are bolted to the spokes. It is also possible to employ a gear case in this arrangement, whereas this is impossible when the sprockets are bolted to the spokes. The axle boxes are made similarly to the long bolted mail-coach pattern, with a plate at the back of the collar, so that it is impossible for the wheels to come off the axles unless they are absolutely broken up. The steering mechanism also presents some new features. A powerful foot brake acting on the balance wheel shaft is fitted, also a lever brake acting on the two rear wheels; in addition to which the electric current can be turned off and the cylinders made to act as an emergency brake.

As usual, the Automobile Association, London, have a large and interesting exhibit. Dealing first with motor-tricycles, two types are shown—the Autocycle (a German machine), and the French Barriere. In addition to the ordinary tricycle, a new form is shown, a motor-sociable-tricycle, arranged to seat two riders side by side. Coming now to petroleum carriages, the first to be noticed is the "Orient Express," which is made in three forms—the Duc, the Victoria, and the Vis-a-vis, the two first-named seating three and the latter four persons. The "Duc" is fitted with a 4-h.p. horizontal gasoline motor. The ignition is magneto-electric, the cylinders are water-cooled, and the transmission is by means of belts with jockey tighteners. The "Orient Express" carriages, which are of German construction, are exceedingly elegant in design, and low in cost. One of the novelties on the stand is the Kuhlstein-Vollmer petroleum motor-cab, the feature being that the whole of the motor and transmission gear is mounted on the fore carriage. In this case the tractor has been fitted to a carriage of the hansom type, but it may be adapted to any carriage or van existing, and thus affords an opportunity to owners of great numbers of delivery vans and the like to have their carriages changed into motor-carriages



THE KUHLESTEIN-VOLLMER MOTOR TRACTOR.

without a great outlay. The motor is a double-cylindrical one, and develops up to 6 h.p. The transmission is effected by belts, and the two speeds are applied by jockey pulleys. The ignition is electric. The front wheels being not only steering, but at the same time drive wheels, a great feature of this carriage becomes the turntable, which is claimed to greatly increase its manoeuvring capabilities. The carriage was built

in Berlin, the system having been used for some time on vehicles employed by the German Post Office for delivering and collecting mails.

The main feature of the exhibits of the Southern Motor Car Co., of 59 Brixton Road, London, S. W., is the "Georges Richard," light two-seated petroleum motor-carriage known as the "Duke."

The popular little Benz carriages are kept well to the front by Hewetsons, Ltd., of Dean street, London, W., who have eight or nine carriages of different types on view.

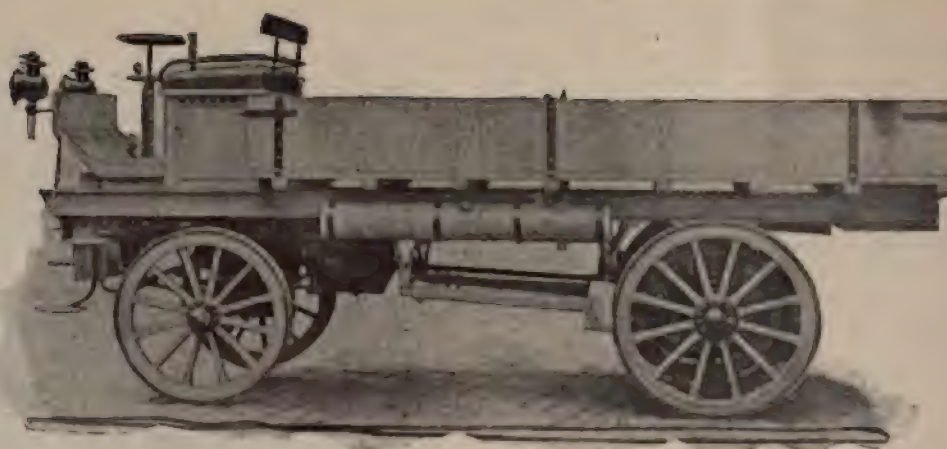
A novelty to England is the "Victoria Combination" two-seated carriage, exhibited by the Societe Parisienne of Paris. The feature of it is that the whole of the motor and transmission gear are dismantled on the front axle, the front



VICTORIA COMBINATION.

wheels being thus both drivers and steerers. The motor is a De Dion single-cylinder one of 1 1/4 h.p., the ignition electric, and the cylinder cooling by means of radial discs, the position of the motor being such that cool air is free to circulate around it. A two-speed gear of the Didier type is provided, by means of which a maximum speed of 22 miles an hour can be obtained, or the motor cut out entirely from the transmission gear. The carburettor is of the well-known Longuemare type. Steering is effected by means of a long bar, on which all the control handles are mounted. The carriage can, it is claimed, mount gradients of six or seven per cent. The wheels are of the suspension type, with pneumatic tires. Shoe brakes acting on the rear wheels and controlled by a foot pedal are provided. Altogether it is worthy of notice as showing what can be done in the way of light carriages.

The Motor-Carriage Supply Co., Ltd., of Donington House, Norfolk street, London, W. C., show a German Daimler lorry fitted with a 7 1/2 h.p. Daimler motor and Daimler transmission gear, and intended for loads of from 3 1/4 to 5 tons. Four speeds forward are provided, ranging from 2 to 8 miles per hour. It is intended for a load of from 1 1/2 to 2 tons. A Cannstatt-Daimler waggonette and a sporting carriage are the next vehicles which call for mention; these are fitted with a 5 1/2-h.p. motor, and four speeds ranging up to a maximum of 16 miles an hour. They possess several novel features, the most important of which is the method of fixing the motor, which, together with the speed-gear, is mounted upon a separate tubular frame, so as to greatly minimize the vibration imparted to the main frame and body of the carriage. The Motor-Car Supply Co. also exhibit Simms' "motor-wheel," a motor-scout for military purposes, Simms' petroleum-spirit motor of 1 1/2 h.p. (the feature of which is the large cooling discs), and their well-known magneto-electric ignition device.



GERMAN DAIMLER LORRY.

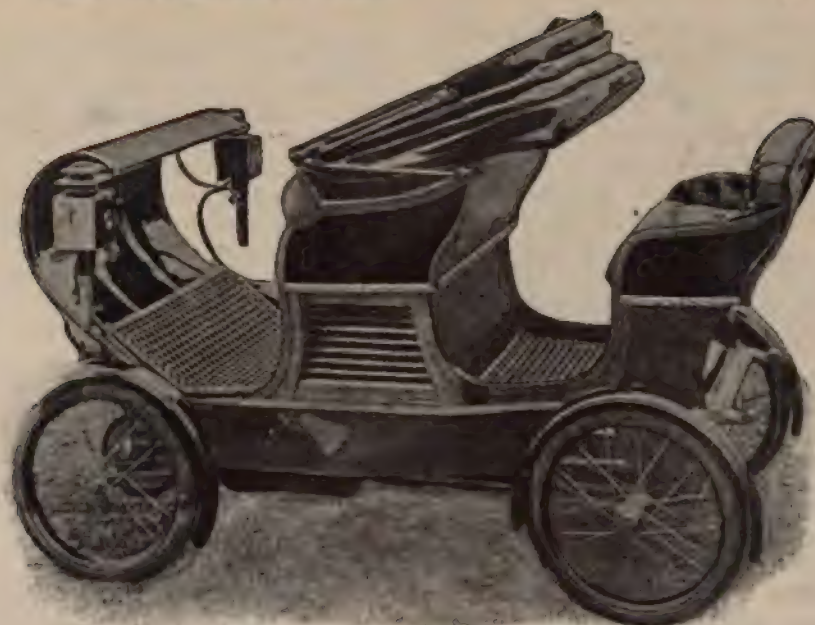
Marshall & Co., of Belsize Works, Clayton, Manchester, are present with a couple of their English-built "Hurtu" carriages, which are fitted with a Benz motor and belt transmission.

Friswell, Limited, of 18 Holborn Viaduct, London, E. C., have a large exhibit of motor-vehicles and motor-cycles. The former comprise carriages of the well-known Mors, Hurtu and Benz types, and the latter are of De Dion and Bouton's construction. A novelty is the "Elan" two-seated carriage.

A vehicle of quite new design is the Oxford three-wheel two-seated carriage, shown by F. Jackson & Co., of 77 Oxford street, London, W. The body of the carriage, which is very attractively finished, is supported on the frame by C springs. The motor is of the vertical single-cylinder petroleum type, capable of working up to $2\frac{1}{4}$ h.p.; the ignition is electric, while radial discs provide for cooling. The motor is arranged centrally in the front portion of the carriage, and is provided with a starting handle. The crank shaft works in an oil-containing chamber. Two forward speeds are provided, the two-speed gear adopted being one of the most simple and compact so far seen. The transmission is effected by belts which normally run slack. On the centre of the rear axle is mounted a large pinion, around which is fitted what may be termed a double-purpose gear case, for, in addition to inclosing the pinion, it serves as the support for two small shafts at the top and bottom, these shafts carrying at one end small pinions continually in gear with the large pinion, and at the other end small pulleys for the two belts. A feature of the device is that in changing from the high to the low speed or vice versa the handle lever pulls round or pushes back the gear case entirely through a short distance, carrying with it the pinions and belt pulleys. Thus, to put in gear the low speed the lever is pushed over; this has the effect of causing the small pinions to simply roll round the large pinion, one receding and so tightening the corresponding belt, the other coming forward and allowing its relative belt to run slack. Thus both small pinions are continuously in gear with the large pinion, although only one can be driving at a time. With the hand lever in a central position both the belts are slack, the motor being thus cut out from the transmission gear. The whole arrangement is exceedingly simple, and has attracted considerable attention during the week. Another feature of the gear is that it enables the belts to be taken off for repair, etc., within a few minutes. Indeed, the representative in charge of the stand took off and replaced one of the

belts in less than a minute in our presence. The frame of the carriage is built up of steel tubing, the wheels being of the suspension type with pneumatic tires. A band brake acting on the differential gear on the rear axle is provided, while the steering is controlled by a hand wheel. The carriage can, it is stated, attain a maximum speed of 15 miles an hour, while with the low gear gradients of 1 in 10 can be mounted. The weight complete is given as 3 cwt., and its price £90. The firm are also building a vehicle of the same type but with four wheels. Another novelty on this stand is a new motor-bicycle which, on first appearance, reminds one of the "Werner." The motor, which is of 1 h.p., is fixed on the "head" of the bicycle and drives the front wheel by means of a cycle chain. The ignition is electric, and the cooling of the cylinder by radial discs. The motor runs up to a speed of 2,000 revolutions, a speed of 20 miles an hour being, it is stated, attainable without resorting to the use of the pedals. The carburettor in connection with this machine is of a new type, so arranged as to only permit a sufficient quantity of petroleum for one explosion to pass at a time.

Pennington & Baines, of 5 St. Hinchester street, London, S. C., are present with no less than half a dozen of his little carriages, and the public has at last an opportunity of seeing these in operation in the demonstrating arena. The pennington motor is mounted under the floor of the vehicle, the fly-wheel being fixed horizontally. The motor drives a horizontal pulley at the rear by means of a light cycle chain, the pulley being now connected to the front wheel axle by a belt in place of a rope as formerly. The wheels are of the suspension type, shod with pneumatic tires; the rear wheels are the steerers, and are controlled by a handle at the side of the car. Another feature of the Pennington carriage is that no carburettor is employed in connection with the motor, the oil being fed directly into the explosion chamber, passing on its way through the exhaust silencer and so receiving a preliminary heating. Although the use of a carburettor is avoided, it is claimed that not only is perfect combustion secured, but every drop of oil is utilized, and the maximum power developed from the amount of hydro-carbon consumed. The cylinder is fitted with both a water-jacket and radial discs, attention being drawn to the small amount of cooling water required to be carried. As the centre of gravity of the carriage is only some eight inches from the ground, and the wheel-base being long, it is almost impossible to upset it, indeed, the stability is so great that it can, it is stated, be swung



THE NEW PENNINGTON-STIRLING CAR.

round in a narrow road when going at top speed. Besides the positive speeds obtained by changing the gears, two of which are provided, any intermediate speed can be got by the regulation of the oil supply, the oil being passed to the motor from the tank in which it is stored through a needle valve, and a quarter-turn of the valve handle, conveniently placed within reach of the driver's hand, will decrease or increase the oil supply, and the result on the motor is instantaneous. The entire motor and its mechanism, with the horizontal fly-wheel, is placed below the level of the framework, and consequently the carriage builder finds no obstacle in the way, but has free scope for the exercise of his skill in getting out a commodious and elegant super-structure; in fact, different types of bodies can be fitted on the same frame. The "Universal" carriage is fitted with a single-cylinder motor, by means of which a maximum speed of 16 miles an hour can be attained. The new Pennington-Stirling has a twin-cylinder motor, which permits the carriage to be driven up to a maximum speed of 30 miles an hour.

Quite a new departure is the Pennington motor-tricycle. This is fitted with a Pennington vertical motor, with electric

ignition and radial discs. A feature is the absence of the usual carburettor, the formation of the carburetted air being carried out on the same system as in the Pennington carriages. The motor works up to about $2\frac{1}{4}$ h.p., enabling a speed of 30 miles per hour to be attained. The motor pinion drives the spur wheel on the rear axle direct, but a new departure is the introduction of a friction clutch, so that the motor can be kept running while thrown out of gear, a great advantage when riding in crowded thoroughfares.

F. C. Blake, Ravenscourt Works, Hammersmith, W., shows for the first time a new two-seated gasoline carriage which at first sight one would take to be a Benz. It is, however, fitted with new type of 3 h.p. horizontal gasoline motor, with magneto electric ignition. Transmission is effected by belts, while there is also a new feature in the steering gear, of which particulars cannot yet be obtained.

KEROSENE CARRIAGE

The only carriage in the exhibition propelled by ordinary kerosene is that shown by E. A. McLacklan, of 55 Brighton road, Stoke Newington. This carriage, which seats two persons, is mounted on either three or four wheels. The body, in which is inclosed all the gear, being of polished walnut wood. The weight of the carriage is only $3\frac{1}{2}$ cwt., and the cost of running is stated not to exceed 24 cents for a 50-mile run. The motor is of the horizontal type with tube ignition and water-jacket, and is capable of giving $2\frac{1}{2}$ actual h.p. Pinions connect the motor-shaft with the crank-shaft, while from the latter to the rear wheels the transmission is effected by means of two slack belts, tightened by jockey pulleys. It is claimed that one carriage can easily attain a speed of 12 miles an hour. Its cost is very low, \$375 for the three-wheel vehicle.

A neat little carriage is shown by Higg's "Champion" Car Syndicate, of 17 Ironmonger Lane, London, E. C. The vehicle takes the form of a small four-seated dog cart. It is propelled by means of a $1\frac{3}{4}$ h.p. De Dion motor. There are several novel features about it, especially in the steering and starting gear, of which I hope to send you particulars later on.



THE MCLACKLAN CAR.

Lawson's Motor Safety Co., of 40 Holborn Viaduct, London, E. C., exhibit the new motor-bicycle, an illustration of which you reproduced a month or so ago. The company are also exhibiting a new motor tandem tricycle and a new carrier tricycle fitted with this type of motor.

The De Le Croix Motor Syndicate, Ltd., of Throgmorton House, 15 Copthall avenue, London, E. C., have on view a new motor quadricycle arranged for two persons side by side. The vehicle, which is of Belgian origin, is fitted with a two-cylinder motor of the De Dion type with belt transmission.

Allard & Co., Ltd., Earlsdon Works, Coventry, have on view three motor-tricycles. The motor is of the De Dion type, and is located at the rear as usual. The cylinder has a 3-inch bore by $3\frac{1}{2}$ -inch stroke, and is claimed to develop up to 2 h.p. Cooling of the cylinder is effected by radial discs, while the ignition is electric, or by means of a lamp as desired. A feature of these machines is that the whole of the parts, including the motor, are of the firm's own construction, this being one of the first English cycle firms to enter thoroughly into the motor movement.

Motor-tricycles are shown by quite a number of other firms including De Dion, Bouton & Co., of Puteaux, France; Noe, Boyer & Co., of Paris; Damas & Clement, of Levallois, France; Brown Bros., London; London Autocar Co., and the British Motor Coupe Co.

ELECTRIC VEHICLES.

The electric vehicle section is represented by three or four concerns, the largest display being made by the Electrical Undertakings, Ltd., of Miller street, Camden Town, London, whose vehicles were described under the Richmond show.



ELECTRICAL UNDERTAKINGS, LTD., PHAETON.

The Mackenzie Carriage Works, of 26 Walnut Tree Walk, Lambeth, S. E., exhibit three electric carriages—a Riker two-seated mail phaeton, a Mackenzie four-seated sporting dog-cart, and a Mackenzie three-seated phaeton.

J. H. H. Berkeley, of Throgmorton House, Copthall avenue, E. C., shows novelty, a one-seated electric bath chair, the motor being inclosed in a case at the rear. The electrical

energy is stored in a small battery of 14 Sherrin cells arranged under the seat, one charge being sufficient for a run of about 20 miles. The switch is arranged to give any desired speed up to a maximum of about 9 or 10 miles per hour, a reverse motion being also provided. For simplicity this little vehicle would be hard to beat, there being only two small handles—one for varying the speed and one for a reverse motion—to control, in addition to the steering handle.

The Joel Electric Carriage Syndicate, Ltd., 37 Walbrook, London, E. C., exhibit the Joel electric motor, specially designed for carriage propulsion; it is of very light weight, slow speed and high efficiency; 2-3 b.h.p. motors; weight only 112 lbs. each. The speed ranges from 600 to 700 revolutions per minute. The Joel patent elastic under frame, forming an independent support for motors, constituting a "perch pole," and allowing the carriages to be stopped and started without jerk or vibration.

The Joel patent controller gives three speeds forward and one speed back, without loss of electric current. Another exhibit is the Rosenthal batteries, which are made up in handy sets of 10 cells, in trays specially made for carriages. These batteries are claimed to be of exceptionally light weight for their output. Each cell weighs 22 lbs., and gives 140 ampere hours.

A neat electrical victoria is shown by Carl Oppermann, of Clerkenwell, E. C. The weight with battery is given as 23 cwt. and the capacity, with one charge, 50 miles.

An ingenious variable speed gear for motor vehicles is shown by Ralph Luca, of Upper Siebert Road, Westcombe Park, S. E. This invention consists essentially of two pulleys, automatically expanded by springs, each driving by belts on to an intermediate twin pulley, so that by shifting the position of the twin pulley relatively to the expanding pulleys, the one is allowed to expand, while the other is forced to contract in diameter, changing the ratio of the diameters, and giving a change of gear. This movement of the intermediate twin pulley can be obtained by a lever or screw as desired. The first experiment in developing this idea, was, of course, to make up a pulley in segments, which parted as the pulleys expanded. This, however, soon proved useless, as the belt made a great noise on striking these segments, one after the other, when the pulleys were run at any speed. A way had then to be found to envelop this pulley with a ring which would give a good belt service, and at the same time would run silently. This was done by making up a ring of lattice work in steel, lazy tongs fashion. This proved very successful, as the strips on which the belt lay arrange themselves helically, so preventing the noise due to the belt striking each segment separately. Then, in order to keep this ring in a uniform circle, and capable of being uniformly expanded and contracted from any point round the circle by applying a pressure, the ring is mounted on a series of supporting bars, which are controlled by a system of toggles, one end of which are fixed to a star plate, free to revolve on the shaft of the pulley, the other end of these toggles being attached to the supporting bars, the end of which slide in radial slots, in plates fixed to the shaft on the two sides of the lattice. These slots act both to take the drive of the belt and to complete the toggle action. Thus, by revolving the star plates relatively to the radially slotted plate, the toggles slide the supporting bars up the radial slots, so expanding the pulley. This function is performed by six tangentially arranged springs.

A further use of this gear for motor work is obtained by placing stops on the driven pulley near the full extent of its

range, thus the driven pulley reaches the limit of expansion before the driving pulley has reached its minimum; the result of this is that as the driving pulley is finally being reduced down to its smallest diameter the driven pulley reaches the stops, so ceasing to keep the belt tight, and performing the function of a friction clutch for starting and stopping, by allowing the belt to slip freely over its surface. This gear combines in a simple pair of pulleys a silent, gradual change speed gear (with a range of 4 to 1), an automobile belt tightener, and a reliable friction clutch.

The Quinby electric carriage, described in my last letter, is herewith shown. It attracted favorable comment by its elegance of design and finish.



THE QUINBY ELECTRIC CARRIAGE, LEITNER'S SYSTEM.

A Newcastle-on-Tyne motor-car service company has, we hear this week, placed a contract for about a dozen gasoline motor charabancs and waggonettes for use in that district. The order is understood to have been divided between the Daimler Motor Co., Ltd., Coventry; the Motor Mfg. Co., Ltd., Coventry, and the London Motor Van and Wagon Co., Ltd.

Reorganization of the Oakman Motor Vehicle Company.

The Oakman Motor Vehicle Co., Greenfield, Mass., is undergoing reorganization at Philadelphia. On Thursday last the Oakman Motor Vehicle Co., of America, was incorporated at Dover, Delaware, with a capital of \$5,000,000, divided into 100,000 shares of \$50 each. The new company will acquire all the patents, good will and property of the Oakman Motor Vehicle Co., of Greenfield, and will equip a large plant in the vicinity of Philadelphia. The directory is composed of the following gentlemen: R. N. Oakman, Greenfield, Mass.; Charles H. Cook, Trenton, N. J.; Richard G. Oellers, Philadelphia; Col. James H. Lambert, Philadelphia; Theodore P. Gittens, Philadelphia; William Weinert, Philadelphia; Job. H. Jackson, Jackson & Sharp Co., Wilmington, Del.; Creed M. Fulton, Washington, D. C., and ex-Senator Jno. H. Patterson, Lancaster, Pa. Max E. Hertel, of Greenfield, and Thomas Shaw, of Philadelphia, will be the consulting engineers. Of the capital stock of the

company \$500,000 will be 7 per cent. preferred stock, subscribers to which receive an equal amount of common stock, full paid and non-assessable.

The General Electric Automobile Co., Philadelphia, Pa., F. S. Pusey, President, and John M. Butler, Secretary and Treasurer, will make a specialty of delivery wagons, of which they will soon show several styles.

The Rubber Tire Co., 1217 Market street, Philadelphia, Pa., have a new semi-pneumatic tire which they claim is well adapted to motor carriages. It is called the Lattina Cellular Tire, and is composed of small interior air cells separated by strong walls of rubber, so that a puncture cannot injure more than one or two of them, and a deflated tire is an impossibility.

The strong motor truck, which has been in course of construction in Philadelphia for several months, is reported nearing completion. The motive power is kerosene, and a novelty in transmission is promised by the inventor, Geo. S. Strong, of New York.

Impressions of Motor Progress Abroad.

Albert T. Otto, President of the American Motor Co., New York, who has just returned from Europe, visited both the Paris and London automobile shows and went to some of the leading motor centres of Germany in the course of his travels.

He states that Bergmann, of Goggenan, Germany, has one contract from a London company for 300 wagons a year for a period of ten years, with a 10 per cent. increase each year.

At the Decauville factory in France they were just shipping the 312th carriage of the style the American Motor Co. secured the exclusive rights for in the United States. This concern exhibited eight vehicles at the London show, all of which were immediately sold, and one of their drivers made an average of \$20 a day, taking visitors riding, arrangements having been made with the management by which drivers received three pence for each passenger.

Mr. Otto speaks in the highest terms of the Paris Exposition. Fully 2,000 outfits, he estimates, motors included, were there shown, experimental machines and parts of mechanism giving the great display additional value and interest.

Automobile Flower Day, when the motor carriages came pouring into the city from the suburbs in all directions, he described as a most beautiful festival. The spokes of the wheels and other parts of the vehicles were gaily decorated with all kinds of garlands and flowers.

He was a guest of the Automobile Club at their country house at the very time when the police arrived on the scene and notified them of the ban that had been promulgated, and gave them half an hour to finish dinner.

With respect to the mechanical conditions on the other side Mr. Otto thinks great strides have been made in design and finish though the fundamental principles remain the same. On the part of the French makers there is a tendency to complicate the machinery by the addition of unnecessary contrivances.

Most of the business in Paris is being done by half a dozen large concerns, all of whom were early in the field and have established a reputation for good workmanship. These concerns have orders six or eight months ahead.

THE PARIS EXPOSITION.

GASOLINE AND STEAM VEHICLES.

The chief novelties in the gasoline line at the Tuileries were the light carriages (voiturettes) weighing from 600 to 900 lbs., shown by nearly all the leading manufacturers. These vehicles are distinguished by a general reduction in weight as compared with the standard types of manufacture. The Peugeot voiturette is so arranged that either electric or tube ignition may be used. The De Dion & Bouton machine has a single-cylinder vertical motor, while the Panhard & Levassor has a new steering arrangement, the front axle being swiveled in the centre, where the tubes of the frame converge and the steering rod having at its lower end a pinion which turns on a toothed rod communicating with the axle.

One of Panhard & Levassor's carriages was shown fitted with what is called a magnetic gear, the motor being thrown into gear by means of two plates brought together by magnetic attraction, a small dynamo furnishing the power.

What might be considered a novelty at this late day was a voiturette, exhibited by Ernst & Co., 13 rue Laffitte, in which the old abandoned friction disc transmission is used, the discs being at right angles to each other.

The Societe des Etablissements Decauville Aine, 13 Boulevard Malesherbes, Paris, exhibited for the first time a gasoline carriage for four persons. It is propelled by a 5-h.p. vertical motor placed in front, power being transmitted by a shaft and spur wheel gearing direct to the rear axle. There are four speeds. The carriage work and mechanism are well constructed and the impression of the machine is generally favorable.

In the De Dietrich stand was a racing carriage, which, it is said, will run 20 hours on one charge of water.

A. Darracq & Co., Suresnes, made their bow to the public with seven carriages built on the Leon Bollee system. Tube ignition is used and belt transmission, four speeds and a reverse being obtained. There was little change from the Bollee system as seen in the well-known voiturettes.

The Gladiator Co., formerly makers of tricycles only, exhibited a carriage seating 12 and propelled by a 12-h.p. motor. Power is transmitted by three chains, giving two forward speeds and a reverse, similar to transmission devices recently described in the Horseless Age.

A single cylinder 4-h.p. motor having two pistons, the explosion taking place in the chamber between them, was shown by L. Bardon, 61 Boulevard National, Clichy. It was placed transversely in front of a light carriage for three persons. Each crank carries two small fly-wheels, the shaft being geared onto the countershaft by spur wheels. Three speeds are provided.

The Societe des Automobiles Canello-Durkopp, 7 Villa des Bruyeres, Courbevoie, has been formed to exploit in France the Canello-Durkopp motor, which is said to have been meeting with success in Austria and Germany. Two carriages were exhibited on this system. The motor, of the vertical type and situated in the forepart of the vehicle, is claimed to be the simplest yet made, and very little water is needed for cooling, as the motor will run when it is boiling. Special attention has been given, however, to the cooling of the valves, and the carburetor is flanged internally so as to keep up the temperature. The gas mixture is fired by an incandescent tube. The transmission is by spur wheels with chains from the intermediary shaft to the driving wheels.

In steam vehicles the novelty was, as usual, a Serpollet machine driven by a four-cylinder simple engine, the cylinders being placed in pairs at an angle of 45 degrees. Stuffing boxes and sliding valves are done away with, and steam is cut off at any part of the stroke by means of a sliding rod brought into play by a knob underneath the steering wheel.



THE NEW LIGHT SERPOLLET STEAM CAR.

The Serpollet generator is placed in the rear, and is fired by 12 burners consuming kerosene. The quantity of steam raised is regulated by the admission of the oil and water in the proportion of ten parts of water to one petroleum, and this is done by a pump operated by a cam of varying diameter, so that the pump forces more or less fuel and water, according to the diameter of the cam brought to work upon it. In starting the carriage two movements of a hand lever force the oil into the burners and the water into the tubes, and the engine runs by putting down a foot lever. This done the carriage requires no attention. A very large condenser is underneath the vehicle, and it is claimed that with its usual supply of oil and water the carriage will run 90 to 100 miles. A lighter type of carriage weighing 2,000 lbs. was exhibited, fitted with a 6-h.p. engine, but the attraction of the stand was a voiturette weighing 550 lbs., and seating two persons. The 3-h.p. engine has four cylinders arranged horizontally in pairs, its total weight, including the case and everything, being only 60 lbs. Except for the motor the arrangement of the mechanism is much the same as in the other vehicles. The water and petroleum tanks carry supplies for 35 miles.

For a number of the half-tones in this article we are indebted to the *Autocar*.

ELECTRIC VEHICLES.

The display of electric vehicles at the Tuileries last month must have gladdened the hearts of the supporters of this mode of locomotion. At the Salon du Cycle of 1897 only one electric vehicle was in evidence, a coupe of M. Darracq. At the first International Exposition last year there were 10 exhibitors, showing 29 vehicles; while at the exposition just closed, 19 exhibitors showed 63 specimens of their handiwork.

The following table, taken from *La Locomotion Automobile*, will give an idea of the number of exhibitors and the class of exhibitors:



THE NEW FOUR-SEATED DECAUVILLE.



THE PIEPER PETROL ELECTRIC CAR.

Exhibitors.	Pleasure	Carriages. Cabs and Coupes.	Omnibuses.	Delivery Wagons.	Miscellaneous.	Totals.
Amiot et Peneau.....	..	..	..	..	1	1
L'Autocab .....	..	1	..	..	..	1
L'Automobile	2	..	..	..	..	2
Cleveland Machine Screw C.	5	..	..	..	..	5
Compagnie française des voi- tures electromobiles	1	5	1	2	..	9
Compagnie internationale de transports automobiles	2	1	..	1	1	5
Durey-Sohy .....	..	1	..	..	..	1
Etablissements Pieper.....	..	..	..	..	1	1
Guiet et Cie .....	..	1	..	..	..	1
La marque Georges Richard	1	..	..	..	..	1
Jeantaud	1	3	..	..	..	4
Ch. Milde et Cie.....	..	..	..	2	..	2
Henry Monnard	1	..	..	..	..	1
Patin et Requillard	6	1	..	..	..	7
Societe anonyme des appli- cations electriques	1	..	..	..	..	1
Societe des voitures elec- triques et accumulateurs systeme B.G.S.....	4	1	..	1	..	6
Societe L'Electromotion (Columbia)	8	..	..	1	..	9
Societes des voitures elec- triques system Krieger....	..	2	1	1	..	4
Vedovelli et Priestley	1	1	..	..	..	2
Totals	33	17	2	8	3	63

Most of the vehicles shown are classified as vehicles "d'agrement," or those in which one of the occupants acts as conductors. Of these 33 were counted, 15 of them of American make. The Sperry electric vehicles, manufactured by the Cleveland Machine Screw Company, are distinguished from the Riker and Columbia vehicles chiefly by the employment of a single lever for the control of the vehicle with the exception of a pedal, which operates a mechanical brake or a "whip," as Mr. Winton calls it, to give a sudden increase of speed. This "whip," which cannot be brought into play unless the controller is on the high speed, diminishes the counter electromotive forces shunting the field coils.

The cabs and coupes were almost without exception those which took part in the recent cab trials, and presented little that was novel. The Jenatzy vehicles are distinguished by the use of a rheostat and three buttons, instead of a controller, an arrangement which seems rather complicated for the ordinary driver.

The cab of Vedovelli & Priestley is worthy of special mention on account of its steering mechanism. The greater part of the weight is carried by the two rear wheels, which are both driving and steering wheels, but whose axis are always parallel to each other. In front there is a single wheel, whose sole object seems to be to prevent the vehicle from toppling over backward, the centre of gravity being located a little in front of the rear wheels.

Each drive wheel has a separate motor with belt transmission, the two motors being connected by a differential consisting of a special system of gears, the intermediate of which is fixed in space. The intermediate has no toothed rim and does not command the wheels, but merely acts as a rigid band between them and insures by its immobility a high uni-

form speed, which corresponds most frequently to the motion of the carriage in a straight line. To turn the intermediates are rotated in one direction or the other around their axes, fixed in space, which compels the two wheels to turn in inverse directions to each other, and with an angular speed, which depends on the speed of the rotation of the pinion of the differential. This produces a difference of speed of the two wheels and a change of direction toward the side having the wheel of the lowest speed. The readiness of the curve described by the vehicle depends on its normal speed in conjunction with the speed of rotation of the intermediate. By a simple movement of the intermediate when the carriage is at rest it can be turned within its own length. One interesting feature in the arrangement lies in the manner of arresting the movement of the intermediate. The carriage continues its movement in the direction last taken without reviving its former direction, thus avoiding the necessity of reversing to quick opposite direction required by other methods. How this will work on a slippery pavement experience alone can determine.

Of the two omnibuses exhibited one was on the Krieger, the other on the Jenatzy system.

The Jamais-Contente, M. Jenatzy's "racing boat," with which he won the kilometer record, was one of the curiosities. The motors are attached directly to the rear axles, the latter forming the axes, and the Fulmen battery is entirely discharged in less than two minutes to accomplish the great speed of a kilometer in 34 seconds.

The "petro-electric" carriage of the establishments Pieper, Liege, Belgium, must be regarded as the greatest curiosity of all. In this carriage both the storage battery and the gasoline motor are employed, the duty of the former being to keep the motor running at constant speed regardless of inequalities of the route. For this purpose a dynamo, connected with a storage battery, is placed between the motor and the transmission. During stops, on the level and in descending hills the dynamo receives the excess of power from the motor and charges the battery. On steep up-grades or bad roads the dynamo acts automatically as a motor, assisting the gasoline motor in its work by drawing from the battery. In consequence of this interchange of function it is claimed that a smaller gasoline motor, dynamo and battery may be employed, and that the chances of being stalled through derangement of parts are greatly reduced. The batteries are always charged to the point of saturation, hence there is no danger of sulphating, and the discharge rate is very much higher. The Pieper system is quite similar to that of the Patton Motor Co., of Chicago, whose motor truck has been noted in our columns.

The Societe des Voitures Electriques et Accumulateurs Bouquet Garcia and Schivre, Neuilly, exhibited four new vehicles. The spur gears of the driving mechanism are so arranged that they can be taken apart and cleaned, if necessary. One motor is employed instead of two, having two windings and two fields, so that it is possible to get four combinations representing four different speeds without changing the couplings of the battery or the excitation, and the batteries may be grouped in series without being connected up for the different speeds. The batteries being always connected in series no inconvenience except a slowing down of the vehicle, will be experienced if one or two cells should get out of order. The weight of the battery, which it is claimed will propel a vehicle weighing 2,000 lbs. 50

miles, is about 575 lbs., said to be the lightest cell made for its capacity. There are six forward and two reverse speeds, and an electric brake.

The Sperry system was fully described by the author in our last issue.

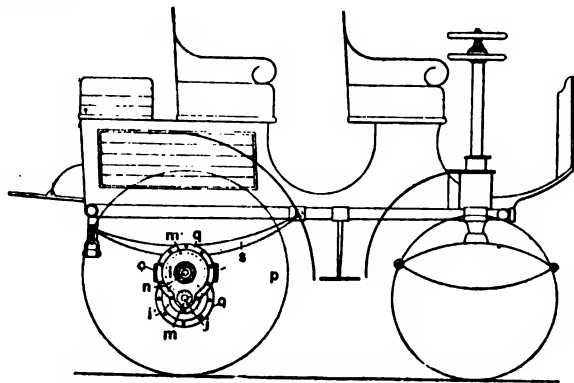


FIG. 1.—ELEVATION OF MONNARD CARRIAGE.

La Locomotion Automobile gives a very full account of a light electric carriage designed by Henry Monnard. It is a phaeton seating five and carrying the motor on the rear axle or in front, if preferred. The frame and springs are so constructed that any kind of body may be used. Roller bearings are employed.

To do away with the differential and secure a low angular speed the motor has two armatures in the same magnetic field. The field has no yoke, the windings, c and d, (Fig. 3),

being made around the poles e and f. Hence the magnetic circuit is closed simultaneously by the two armatures which are crossed by the same flux. If there were a yoke each armature would be crossed by only half of the flux, and for the same number of amperes we would have twice the speed for the same difference in potential. The motor makes 600 revolutions a minute.

This system of closing the magnetic circuit by two armatures permits the use of rings of small diameter; for this motor may be compared with one of the same power but having an armature of twice the diameter, which given the same electromotive force would result in double the circumferential speed. The two armatures being always in series only half as many wires are needed as are required with parallel mounting, which reduces the air gap half and lessens the resistance of the commutator brushes.

Fig. 4 represents a section of the motor through x x1. The two armatures are on the same shaft but are separated from each other and run on roller bearings. The commutators, V and V1, are within. The brushes are placed vertically in an arm and are brought to bear upon the commutators by means of the springs r1, r2, r3 (Fig. 2), which extend into a recess in the upper part of the carbon.

The motor is said to be new, each armature operates the corresponding wheel by means of a piston I, meshing with a gear ix controlling the axle through a pinion m, and gear n, an arrangement rendered necessary in order to make the axis of the motor coincident with that of the axle. The motor weighing 125 pounds is enclosed in a case of composition like the gearing, which though easily worked is very hard to bend.

Fig. 3

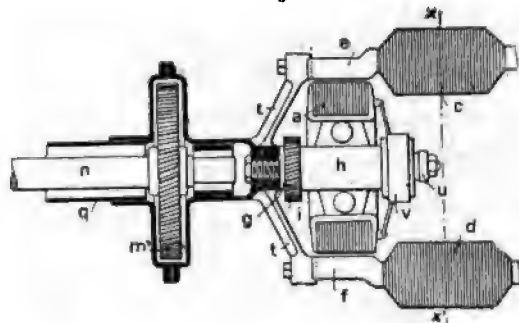


Fig. 4

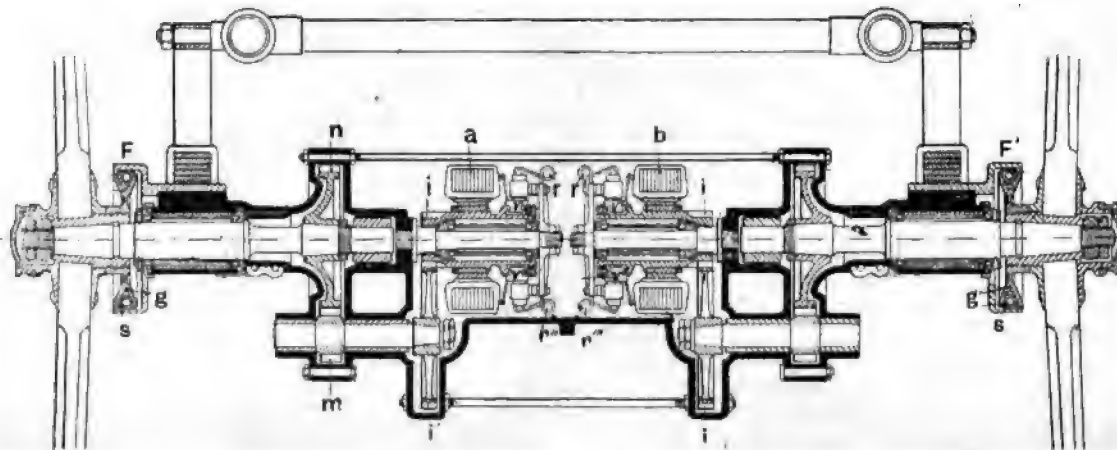
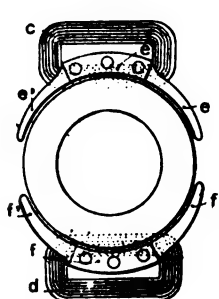


FIG. 2.—VIEW OF MOTOR AXLE.

No differential is needed. If the resistance at the rim of one of the wheels increases, the corresponding armature slows down without affecting the other, because both are loose upon the shaft. In consequence of the retarding of one armature the counter electro-motive force of the armature is diminished, and the difference of potential will increase up to the limit of the other ring, the speed of which will follow the same variation. With this device it is said the vehicle can be turned without backing in a space of fifteen feet.

Another novel point about the motor is the separate excitation of the field. Instead of being taken in shunt or in series to the terminals of the motor the current is derived from a storage battery of four cells, thus producing a constant field and a speed variable only with the difference of potential at the terminals of the battery, and in descending hills the batteries may be recharged because the motor acts then as a generator.

The motor is rated at four H. P., and the carriage weighs about 2,300 pounds with its complement of five passengers. Hence at a speed of fifteen miles an hour on a level road we have

$$\frac{25,000 \times 1000 \times 0.0008}{3600 \times 75} = 0.861 \text{ h.p.}$$

Estimating the efficiency at seventy-five per cent. we find that the amount of power required would be 1.14.

Theoretically a H. P. = 746 watts; in practice let us admit that 1,000 watts are required to produce a H. P., which at 80 volts would necessitate a current of an intensity

$$I = \frac{1.14 \times 1000}{80} = 14.25 \text{ amperes.}$$

If the motor at fifteen miles an hour requires 14.25 amperes, it is easy to see that with four H.P. hills will be ascended with ease. The current passing into the armature will have a density of 3.5 amperes per m. m. of section of the wire.

The storage batteries are of a special Planté type. The plates are composed of a grid of lead-antimony as light as possible in which is a series of strips alternately corrugated and channeled, the corrugated overlapping the channeled. All these strips are electrically soldered and fastened to the grid at the extremities by solder. Between the ends of the strips and the grid is a space of five m. m. to allow the expansion of the strips. Each plate therefore has a thickness of eight m. m., a breadth of 130 m. m., and a length of 200 m. m., presenting an active surface of about 14-dm² and weighing two and one-half pounds. Each element weighs twenty pounds, and the 44 elements constituting the battery, about 850 pounds, i. e., fifty per cent. of the weight of the carriage without the passengers. Of the 44 cells 40 are utilized for the motor and four, in two groups of two each, for excitation.

The controller is composed of a cylinder of lignum vitae on which are copper plates effecting the various groupings between the terminals and the batteries, as shown in Fig. 6.

The current is closed for the charge at A by means of a plug and at B for the discharge by means of the same plug, which is removed from A. From these combinations six speeds forward and six backward are obtained. Fig. 5, shows the different combinations obtained for the forward speeds, the reverse speeds being obtained by the same couplings but the current being reversed in the motor.

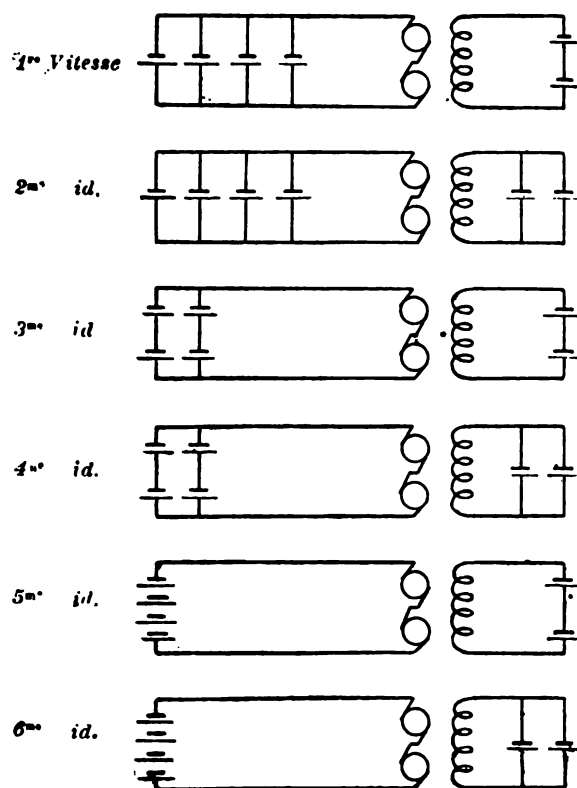


Fig. 5

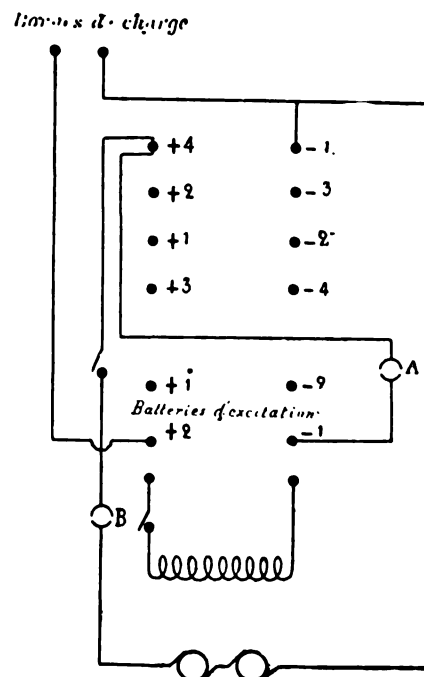


Fig. 6

CONTROLLER COMBINATIONS.

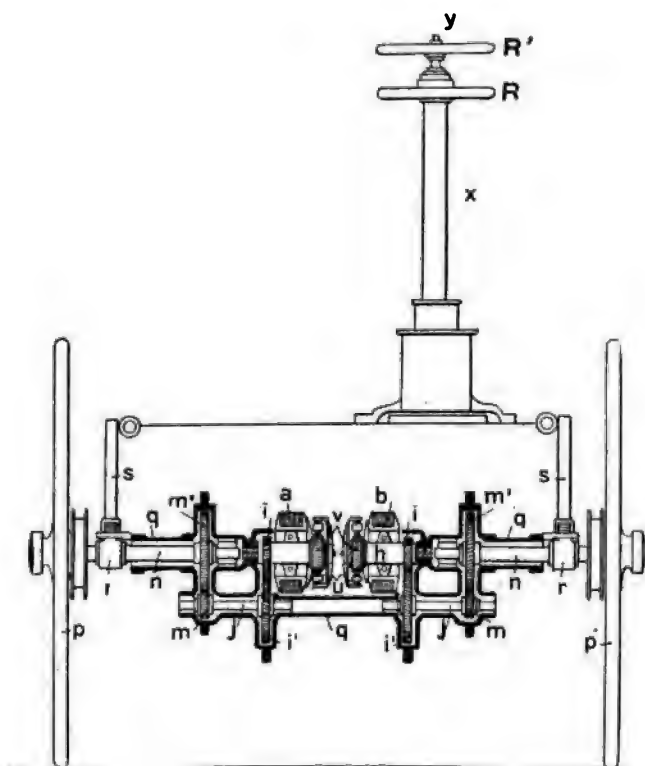


FIG. 7. REAR VIEW OF CARRIAGE.

A lever R, (Fig. 7), operates the controller, an index showing the different positions for the changes of speed. Above the lever R, is the steering lever R', operating an axis Y, concentric with the axis of the controller. At the lower end of Y are placed one above the other two pinions 15 m. m. in heights, which engage a toothed sector 30 m. m. high, giving direction to the front axle. Each pinion is separately movable around Y, so that in case of excessive wear they may be moved in a horizontal plane, so that the sector may always be properly meshed.

Three brakes are provided: An ordinary mechanical brake, a shoe brake and an electric brake. The shoe brake is concentric with the hubs, see F and F, (Fig. 2). It consists of a series of small shoes, s, s1, strung on a cable of steel wire and separated by copper tubes of about the same length as the shoe. The two end shoes are connected by a steel spring. In the upper part of the box containing the controller is a small lever connected to a pedal beside the controller. When the lever is raised the spring prevents the brakes from working, but if the pedal is used the lever is lowered and brings the first shoe on the channel g, on the hub; the other shoes are brought into play, producing the desired effect. If the pedal is further pressed the current is cut off from the battery.

The electric brake is obtained by putting the armature in short circuit, and may be applied suddenly or gradually, recharging the batteries. To bring the vehicle to a stop instantly, the shoe brakes are first applied, then the current is cut out and finally the electric brake is used.

The roller bearings are in the hubs of the forward wheels and at r, in the rear axle.

According to the inventor's figures the carriage consumes 11.5 amperes at three miles an hour, 12.2 at seven miles an hour, and 14.2 at fifteen miles an hour. The battery having a capacity of 115 ampere hours at a 14 ampere discharge

rate a distance of over 100 miles on a level is claimed to be possible on one charge. At a speed of fifteen miles an hour the consumption of energy is 47.33 watt hours per ton—kilometer of total weight.

In his future vehicles M. Monnard will increase the size of the poles of the motor in order to decrease their saturation, and increasing also the length of the armatures he will have for the same value of magnetic field a lower speed, about 450 revolutions. Moreover, the motor will be placed in front of the axle and will have only a single train of gears for each armature.

Boston Aldermen Seek to Control Motor Vehicle Licenses.

Mayor Quincy, of Boston, Mass., has vetoed the amendment to the revised regulations by which the Aldermen sought to obtain control of the licensing of motor vehicles. The regulation, as amended and passed on June 29, reads as follows:

No person shall in any street use any vehicle other than a railroad or a railway vehicle, or a vehicle of the Fire Department, or a vehicle drawn or pushed by an animal, or a vehicle of a construction approved by the Board of Aldermen as not endangering the life or property of others.

This amendment caused a warm debate in and out of secret session, and was passed by a vote of 7 to 5. One member of the Board tried in vain to secure the adoption of this addition to the section:

Provided, however, that nothing in this section shall be so construed as to authorize the Board of Aldermen to grant a permit for the use of vehicles propelled by one system of motive power to the exclusion of other systems of motive power.

Whether it will be possible to pass the regulation over the Mayor's veto remains to be seen. One more vote is needed.

Steam and Gasoline Pacing Machines to Race.

F. O. Stanley, Newton, Mass., has issued a challenge for a motor race to cover a distance of 10 miles. Mr. Stanley will use the steam pacing machine which recently made a mile in 1.47. The challenge has been accepted by the Waltham Mfg. Co., Waltham, Mass., agents for the De Dion motors in the United States. The Waltham Co. prefer five races of one, 10, 25, 50 and 100 miles respectively and in different cities of the East.

Paris to Rouen On One Charge.

Count Chasseloup Laubat recently drove an electric carriage from Paris to Rouen on one charge, a distance of 92 miles, returning by the same road after having recharged his batteries. The batteries carried weighed about 2,000 lbs. M. Kreiger now announces that he will undertake to go from Paris to Dieppe on one charge, a distance of over 105 miles.

COMMUNICATIONS.

Unrestrained Enthusiasm and Ignorance.

Peoria, Ill., July 13th, 1899.

Editor Horseless Age:

One feature that is doing much to damage the automobile is the unrestrained enthusiasm of some people who know little or nothing about it. They see in the future an absolutely perfect machine on which they base their hopes, assertions and comparisons. To them the motor vehicle is a horse vehicle having a motor on an axle, a couple of dry batteries under the seat and a convenient push button. This should have little weight, cost little and, because of its simplicity, give little trouble.

It is supposed to be operative by anybody to perfection and without previous experience. A freight car brake wheel for steering, a trail of dust behind, frightened chickens, horses and dogs in front and flying hats and hair on board completes the picture.

The actual is far different. Favorable results cannot be secured without a powerful motor. Even in a two-passenger vehicle this should be capable of developing 5 or 6 h.p., when required. To avoid vibration it should have more than one cylinder if gasoline or steam is used, while if it is an electric motor it must have large battery space in order to have much ability.

Hills and mud require some sort of gearing to enable the motor to meet the requirements. An easy yet sensitive and positive steering is necessary. All these things require mechanical parts and therefore require that these parts should be well designed, well arranged and well made. No other service is so severe as motor vehicle service on the mechanical parts. A motor that will drive a boat or give good satisfaction as a stationary may be an absolute failure as a vehicle motor. Even mechanical engineers fail to recognize this fact, although they well know that special appliances produce the best results in almost every instance.

The motor vehicle, therefore, must be expected to be specially made and to have an appearance all its own and not that of a run-away horse vehicle. While it usually has plenty of speed it has no appearance of being a run-away because there is no sign of labor to it. The noise of a first-class machine is much less than that of a horse vehicle and since there are no dragging feet there is much less dust stirred up.

In having no horse to watch the passengers in a motor vehicle have but a faint idea of the actual speed of the machine. If the road is smooth they imagine the pace to be slow, if it is rough they think the pace is fast, while with spectators the reverse is apparently true, for a motor vehicle running faster than a horse would walk over a rough street is imagined to be out of order and about to stop, while if driven at only 8 or 10 miles an hour on good streets it is pronounced to be going like an express train. Therefore education is advisable as rapidly as possible on these points.

Over enthusiasm also leads prospective purchasers to imagine that anybody can handle a motor vehicle to perfection without previous practice. They are well aware that sewing machines, typewriters, pianos, locomotives and even so simple a contrivance as an ordinary stove, require more or less experienced handling to secure the best results, but they give this matter little thought in connection with the

motor vehicle. They forget that when a mere child they first held the lines while "Old Bobbin" demurely trotted along and only remember that almost everybody to-day can drive a horse.

Because of this forgetfulness they are often disappointed with their first motor vehicle experience and pronounce it erratic to guide, difficult to manage and unreliable in action, when, as a matter of fact, after a few weeks' experience they have been possible, and with a low vehicle equipped with become second nature, like steering a bicycle.

Then handling the vehicle is done without worry or nervous strain and the vehicle becomes almost human, capable of obeying the will of the driver under any reasonable circumstance.

If motor vehicle buyers will keep these facts in mind and learn to properly manipulate their machines before showing them to their admiring friends, they will get greater pleasure, the machine will get more credit and such accidents as upsetting backwards, recently reported in the daily papers, will not occur. As a matter of fact such an accident should not have been possible and with a low vehicle equipped with proper brake would have been very unlikely, to say the least.

CHAS. E. DURYEA.

French System of Muffling—Tube vs. Electric Ignition.

Coden, Ala., July 10th, 1899.

Editor Horseless Age:

Frequent mention is made in your paper of the French system of muffler in explosive motors. Will you kindly explain of what this system consists?

I would also like to ask what the principal objections are to tube ignition as compared with electric system, when used in motor carriages.

Yours respectfully,

D. R. L.

ANSWER.

1. The term is sometimes used to indicate a practice in motor design frequently adopted by French designers; namely to heat the "petrol" by a suitable combination of muffler and carbureter. For example, in the tricycle manufactured by the Gladiator Co., the designer, Mons. Darracq, has arranged the muffler so that the exhaust takes place in the lower part of a box containing the gasoline reservoir with the object of assisting vaporization. The De Dion-Bouton arrangement attains the same object by branching, with a "tee" at entrance to discharge box, and passing a pipe through lower half of carbureter. This plan of utilizing the heat of exhaust is not nearly so dangerous as it seems and the method is perhaps the only practical realization of Dr. Siemens' "regenerative" projects in relation to explosive motors.

2. The principal objection to tube ignition is in the possibility of the highly heated tube accidentally coming in contact with inflammable material; see page 17 of the Horseless Age, for July 12, 1899, a special prize having been offered at the Richmond Show for the best means of extinguishing the flame in tube igniters when the vehicle is overturned. There are several minor objections, as, for example, the precarious

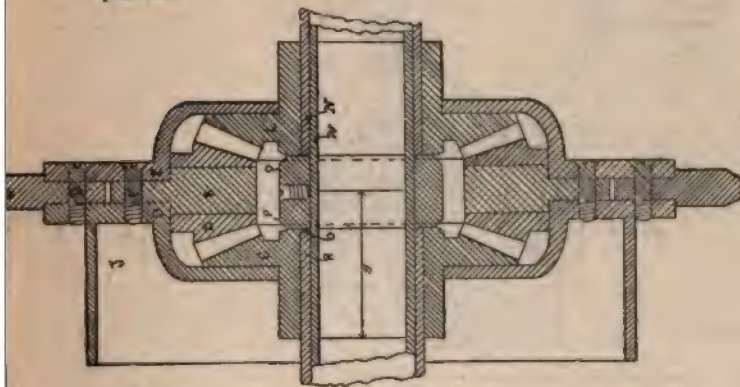
life of a tube which is supposed to be at a dull red but is liable to be at any temperature up to a white heat. Thin material is essential unless a large heating flame is allowable, thus wrought iron does not wear so well as nickel or porcelain; and here again the expense of the one and the fragile character of the other is objectionable. Unless a timing valve of some kind is provided the point of ignition is fairly constant with the tube; whilst the electric spark is easily capable of being retarded to change the speed. On the other hand the electrical points in the cylinder are coated with carbon and, where springs are employed, the high temperatures are inimical to good service. Of course there are expedients to separate contact points where the elasticity of the springs has been impaired, but this really increases the complication. In the "Loyal" motor tube ignition of a peculiar type has been tried and the principle is worth further experiment; briefly the system may be explained thus: A lamp is employed to heat the tube until the motor is running, then the burning material retained in tube and fed at each explosion is relied upon for ignition. This plan lacks elasticity, though feasible for constant speed and load, and the scheme in view of its advantages is worth further consideration by motor vehicle designers.

R. I. CLEGG.

Compensating Bevel Gears.

The cut below is a sectional view of bevel gears with break and sprocket wheel designed chiefly for the driving axle of motor vehicles by the Boston Gear Works, Boston, Mass.

The bevels L and C are secured respectively to the hollow shafts N and R. These shafts, which are independent of each other, are reinforced by the tubing W which is held in place by means of the collar P. The two bevels mentioned are driven by three pinions B. The cut illustrates only two pinions.



When the power is applied to the sprocket wheel G the power is equally distributed to the bevel gears C and L by means of the pinion B, and two other similar ones which pinions in driving do not revolve on the stud A. These pinions being loose on the stud A, when one bevel offers more resistance than the other (as is in the case of the vehicle turning a corner) it is obvious that the bevels can adjust themselves according to the resistance offered.

D and E represent a section of case for holding the parts together.

J is a friction device for brake purposes.

The cut is about one-half size.

High Test Steel Tanks, Tubes and Cylinders.

Owing to the recent increase in the demand for special light-weight, high-test, seamless drawn, bright steel tanks, Janney, Steinmetz & Co., Drexel Bldg., Philadelphia, Pa., have equipped largely in special drawing presses for making up steel tanks without seam or weld and tested to 500 to 3,000 lbs. They are making shapes for the Government and for light buoys, large cartridge shells, reservoirs for automobile torpedoes, tanks for compressed oil burners and for petroleum atomizers, tanks for automobiles and all classes of seamless drawn steel shells and high-test seamless tanks, as well as steel tubing for frame construction and heavy section tubing for hollow axles, etc.



Having been largely interested in the development of drop-forged parts and steel-stamped fittings for the bicycle trade this company is in position to supply such pieces for motor vehicles. They will develop anything in seamless, light-weight, high-test steel tanks or other special steel work.

Transcontinental Tour.

The Herald transcontinental tourists are making slow progress. On Tuesday, at Little Falls, N. Y., one of the rear wheels gave out through weakness of the rim, and Mr. Davis was compelled to lay to at Utica until Thursday, where a new and heavier set of wheels was supplied by the Weston-Mott Co. of that city, and the journey was resumed.

The accident is said to have been due to the overheating of the steel rim in welding.

Owing to the time required for the cement on the new wheel to set the tourists did not leave Utica until Friday morning. Syracuse was reached in the afternoon, but as they were entering the city one of the cylinders was disabled, rendering it necessary to send to Stanford for another, and in consequence of this delay the tourists are stalled at Syracuse until Wednesday.

Mr. Davis, in commenting on his motto—"Frisco or bust"—said that there had been more "bust" than he had counted on.

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MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 629,064.—Automobile Vehicle. James Felix Tiburce Conti, of Paris, France, Assignor to the Societe Choconie et cie, of same place. Application filed December 15, 1898.

This motor fore-carriage comprises two fixed pivots *a*, carried by a frame *B*, which can pivot upon a bolster-pin or which can move circularly upon a guide-disk *C*. (See Fig. 1.) Upon the two pivots *a* are loosely mounted two wheels *D*, which form the driving-wheels. The hub of each of the wheels *D* carries a pulley *E*, which forms a friction-drum. A second friction-drum *E'* of larger diameter is arranged upon the wheel itself. Through the medium of one or the other of these drums *E* *E'* each of the wheels *D* is actuated either for forward or backward movement. To this end an intermediate shaft *b* carries two friction-rollers *c* *c'*, which can make contact—that is to say, either *c* with *E* or *c'* with *E'*. This shaft *b* does not extend throughout the whole width of the vehicle. There is one of the small shafts *b* upon each side of the driving-frame. Each of the small shafts *b* is supported by a rod *F*, which can oscillate around a fixed point *d* upon the frame *B*. It will be obvious that according as the rod *F* is moved forward or backward the

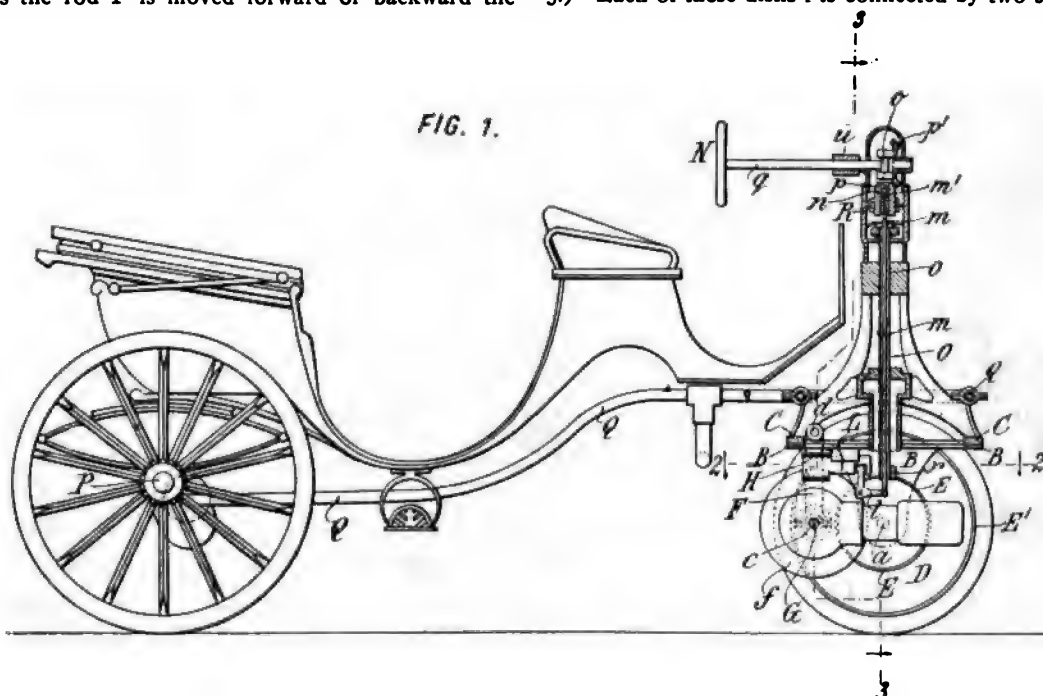
pressed, according as the roller is pressed with a greater or less force upon the drum through the medium of the rod *F*. It will be obvious that it may happen that the pressure corresponds to the coefficient of friction of the leather and that the drum is rotated without any loss of velocity. If the pressure is below this limit, the sleeve will slide simultaneously upon the roller and upon the drum in such a manner that the corresponding wheel will be driven at a reduced velocity. With this arrangement it is possible to vary the speed of the vehicle as desired with a motor of constant velocity. The sleeve *e* being made of soft material will be more opposed to heating than otherwise would be the case, the more so as the sliding which can produce the heating will only be produced when the pressure is small.

The vehicle runs forward when the shafts *b* are moved forward in order that the rollers *c* may come in contact with the drums *E*, and, inversely, the vehicle will run backward if the drums *E'* *E'* are in contact with the rollers *c'*, the small shafts *b* having been moved backward. When the shafts *b* are in an intermediate position, the rollers will not be in contact with either drum and the motor can continue to rotate without moving the vehicle either forward or backward.

The two small shafts *b* are actuated by shaft *G*, which is placed between them and in their prolongation, the said shaft *G* being the motor-shaft or being directly operated from the said motor. As this shaft *G* is fixed since it is actuated by the motor and since the shafts *b* should for the reason above explained be adapted to be moved in a parallel direction to effect contact on one side or the other at a greater or less pressure the following intermediate connection has been designed:

The shaft *G* has keyed upon it two disks *f* *f*. (Figs. 4 and 5.) Each of these disks *f* is connected by two small rods *g* *g*

FIG. 1.



roller *c'* will operate the drum *E'*. The shaft *b* always being rotated by the motor in the same direction, the small drum *E*, with which the roller *c* will make contact, will cause the vehicle to move forward. On the other hand, the drum *E'* when the roller *c'* makes contact with it will cause the vehicle to move backward.

The transmission of the movement of the rollers *c* and *c'* to the drums *E* and *E'* is effected in the following manner: Upon each roller *c* *c'* there is loosely mounted a sleeve *e*, composed of sheets of leather and india-rubber rolled one upon the other, (see detail Fig. 4.) the inside and outside surfaces being of leather. This loose sleeve possesses a certain elasticity. When the roller is applied against the drum, this sleeve is, so to say, "laminated." It is more or less com-

to the two opposite ends of a cross-piece *h* in the form of a diagonal which is free in space, the two other ends of this cross-piece in the form of a parallelogram being connected by the rods *i* *i* to the ends of a cross or balance piece *j*, fixed upon the corresponding shaft *b*. It will be understood that with this arrangement the driving-shaft *G*, which is fixed in position, can actuate the shaft *b* without its being in the prolongation of the driving-shaft *G* and even when the shaft *b* is displaced in a parallel manner according to requirement.

Each of the rods *F* is provided with an eye *k*, and in these two eyes are engaged the ends of a balance or rocking lever *H*, the axis of which is carried by a slide *L*, controlled by a right-angled lever *I*. The end of the horizontal branch of

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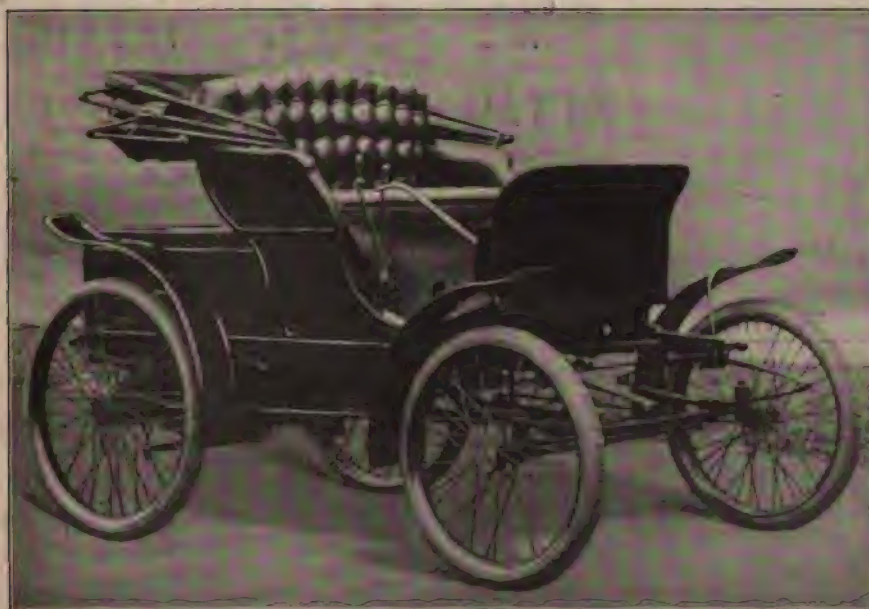
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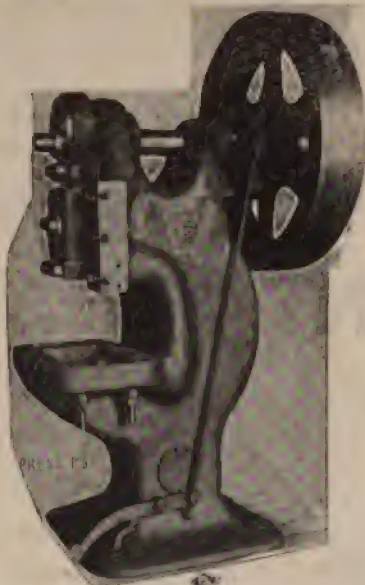
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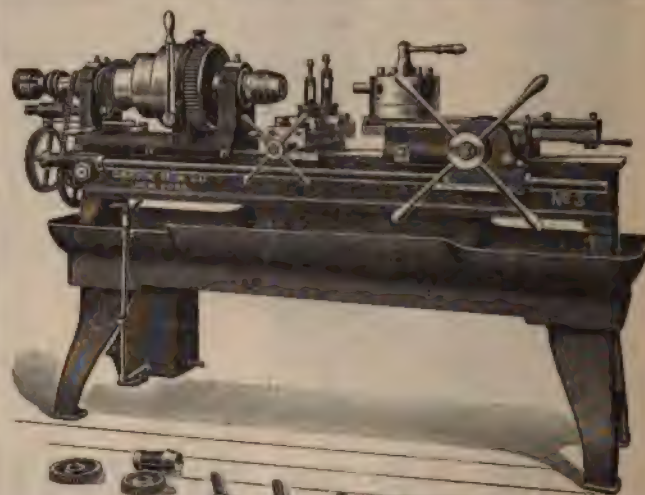
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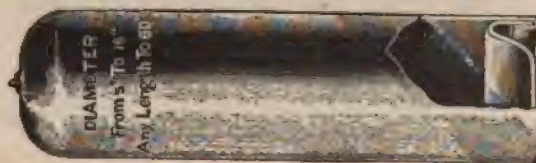
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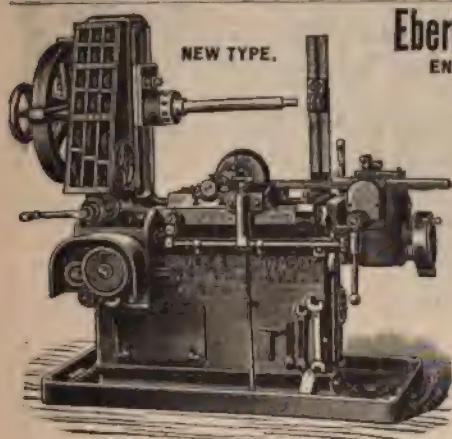
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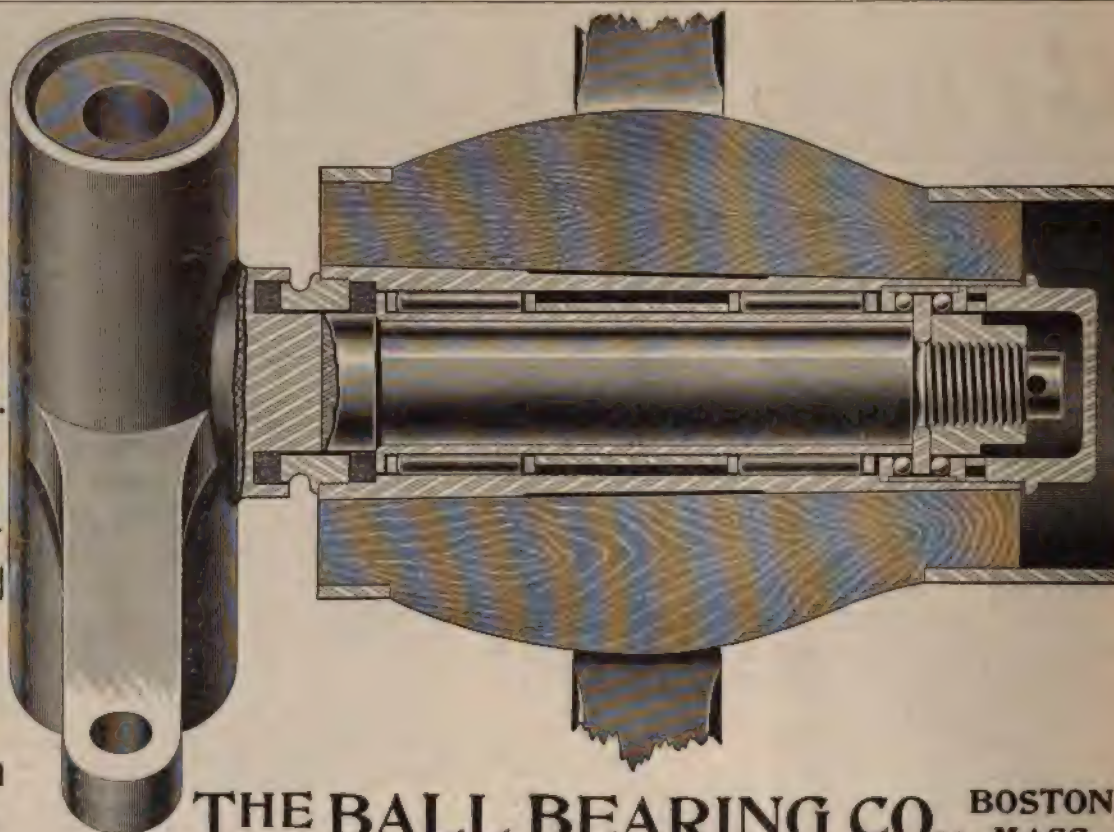
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VOL. IV.

NEW YORK, AUGUST 2, 1899.

No. 18.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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Need of Training Schools.

The article from the French of Yves Guidon which we publish in this number emphasizes the need of training schools for beginners in motor vehicle practice. The tendency in France has been for the novice, the moment he secured his carriage, to rush impetuously onto the road and undertake long journeys and high speeds which would try the stamina of the veteran chauffeur. Of the care of his machine and the little derangements that are certain to occur he knows nothing, and in consequence of his ignorance gets into trouble immediately. He neglects and abuses his machine, meets with accident through his lack of skill in handling it, jeopardizes his own and others' lives, runs up a heavy bill for repairs and roundly denounces the innocent maker, all because he would not take the time to learn his machine before venturing upon the road.

We will undoubtedly go through the same experience here, and American manufacturers should protect their own interests by establishing training schools for their customers at no distant day. Untutored customers are undesirable in any line of business, and particularly in a new industry like this. A good machine badly handled will give less satisfaction than a poor machine well handled, and it is false policy to give customers the impression that the motor vehicle is an automatic machine that takes care of itself and is controlled without effort.

Operating Cost of Horse and Electric Delivery Service in New York City.

The paper of Messrs. Sever and Fliess, read before the American Society of Electrical Engineers last month, shows a great deal of painstaking investigation on the part of the authors. The conclusions are valuable as far as they go, but in the absence of any data in regard to the depreciation of electric deliveries in constant service the case cannot be considered as arithmetically proved. This the authors of the paper themselves acknowledge. Very good evidence that the new system of delivery is meeting with favor, however, is found in the fact that those who took it up tentatively last year are adding new vehicles as fast as they can be turned out by the manufacturers, and that the few companies prepared to execute orders of this kind are unable to keep up with the demand.

It is to users we must go for final proof of the worth of any system.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

"The Thing."

Such a thing never existed as "the thing," the ideal, the perfect, the transcendental thing. Many persons interested in the motor vehicle are waiting for it to appear. They regard with contempt the present status of the art. Steam, gasoline and electricity are not "the things." These useful agents which have made records for themselves in greater or less degree as servants of man are to be quickly discarded in favor of this vague, indescribable wonder that somebody is to discover and so "revolutionize" the motor vehicle industry. Nobody has ever been able to describe "the thing" and nobody ever will. It is perpetual motion; it is born of the delusion that man is able to get something out of nothing; it is not science but mystery and superstition.

The motive agents at present used to propel vehicles are not perfect, nor will they ever be, but they are doing fairly good work to-day and will do better as the persevering labor of men gives refinement to the necessarily crude efforts of pioneers. They are practical at least; "the thing" is not.

Table of Steering Fork Angles.

In conformity with our aim to publish a first-class technical paper, which will be invaluable to the motor vehicle engineer, we have at considerable expense procured for this week's issue a table of steering fork angles, compiled by Harry E. Dey, which should be worth more than the yearly subscription price to every designer in this line. In the article accompanying the table Mr. Dey has given the subject thorough treatment, showing how to apply the table to the different mechanisms embodying the principle of the fork, and also treating the subject generally. We believe it is the first table of the kind ever published.

Where are the "Autotrucks?"

The compressed air trucks which were to be running in New York streets long before this if the stupendous plans of the "autotruck" promoters were carried through, have not materialized. The name of the parent company has also been changed from the International Air Power Co. to the International Power Co. The American rights under the Krieger electric patents are reported to have been purchased by them, and they are known to be pursuing further investigations into motive powers.

Putting two and two together, therefore, it looks as if the skeptics were right and we should not be afflicted with these barbarous "autotrucks" after all. Perhaps when the company really gets down to business we shall have good, common, everyday motor trucks propelled by steam, gasoline, kerosene, anything but compressed air.

Lessons of the Road.

Readers of the Horseless Age are again urged to give us the benefit of their experience on the road in this department. The articles so far contributed have been appreciated and have been instrumental in directing the attention of novices to many useful points relating to the management of motor vehicles on the public highways. Any comical or unusual incident which happens in your outing will be read with relish by other motorists, if you will jot it down and send it to the editor of the Horseless Age.

"The Automobile Arm."

So the New York Herald describes the ailment of Mr. Davis, who is driving a motor carriage across the continent in the interest of that newspaper. The rough roads have so violently shocked the steering apparatus that the operator's arm has been severely lamed in retaining a grip on the lever. This serious defect in about all existing motor carriages has been previously referred to in the Horseless Age, and likewise methods of checking these shocks hydraulically or otherwise, which have been devised by inventors. Certainly some means must be found of relieving the arm of this strain or transcontinental tours will fall out of fashion in this country of bad roads.

IGNITION TROUBLES.

A writer in the *Motor Car Journal*, signing himself "Novice," gives the following list of "troubles" which he has had with his ignition device:

1. The gauzes between cylinder and inlet tube have become coated with carbon.
2. The washer at cylinder end of inlet tube getting loose and allowing air to be drawn in.
3. Within the past few days I put too much oil in crank chamber, consequently it got on to sparking plug and machine would not work. After cleaning plug about twenty times I at last took off cylinder cover and found a quantity of oil on top of piston. I cleaned this off and tried machine again, but still oil appeared on the plug. I took the cover off again and worked the machine on block by means of the pedals, so that I could watch the piston. Oil worked up over the piston, and I thought new rings would be necessary. However, I put the cover on again and tried with three-quarter measure of oil. The machine went for about three minutes at a time, but there was no oil on the plugs, only a little soot; on cleaning this off the machine went for another three minutes, and I came to the conclusion that the batteries had become too weak. As a last resource I put in a third plug and the machine went beautifully. I found that in the other two plugs which I had been trying the platinum point which is inserted in the metal was loose, and I suppose oil had worked down by the side and spoiled the connection,

Accidents of the Motor Vehicle.

(Translated from the French of Yves Guedon.)

The past month has not been fortunate for the motor vehicle. It has witnessed the sudden taking off of several drivers, their deaths brought about by accidents to their vehicles. Excellent conductors some of these, skilled enough to have landed several of the prizes in the Paris-Marseilles-Paris road races, so well posted on the motor industry that the world stands aghast at seeing them the victims of accidents which apparently ought to occur only to novices and to the most reckless of the devotees of this new sport! For those of experience as for the inexperienced, it is exaggerated speed which must be blamed for these misfortunes. But it would be preaching in the desert to ask drivers to slacken their speed. That would be to return to the speed of the team of horses. When they can make 25 miles and more an hour they are not going to slow up to a speed half as great, and so the most prudent motormen allow themselves to be intoxicated by high speed and lay themselves liable to all kinds of accidents. The observations which follow are addressed not to professionals nor mechanics by trade, but to those who drive the motor carriage because they enjoy it merely for pastime now and then.

Accidents increase with the number of neophytes of the pedal and of the "buzz-buzz." If a few hours suffice to make a fairly presentable cyclist quite otherwise is the education of a motor-conductor. First of all he must have a certain mechanical knowledge and then must serve an apprenticeship in his new calling, to which few drivers submit. Once his machine is delivered (generally its owner has waited long months) the impatient conductor has its mechanism and its method of conduct explained to him in two or three movements. Then he is off in all haste, eager to count up the miles and say when evening comes that he has equaled the speed of the express train.

A carriage well oiled and provided with all that it ought to have to assure its operation goes very well the first day. As soon as he arrives at the stable, however, the driver ought to give his first care to his carriage and then think of himself. Unfortunately he forgets to do this.

The second day his troubles begin—the cylinders stick because of lack of oil to lubricate them, or of water to cool them; the tubes are stopped up, preventing the oil and water from performing their work. Or else it is the carburetor which has become dirty and will not flow, or the ignition tube no longer communicates its spark and there is no explosion, the brakes will not work or the axle of the differential has become untrue.

Then follow the entire gamut of mishaps until comes the inevitable "snap" that heaves the motorman to out in the open country in the face of a driving rain or under a boiling sun. He can do nothing, and storms against the builder of the vehicle who has turned over to him this worthless imitation. It is necessary to send to the nearest village for a mechanic or else for a horse to draw back equipage and its occupants, their heads hanging before the jeers of scoffers. Once arrived at a place of refuge, the cause of the stoppage must be learned. Heroically he sets to work to take things to pieces; he lies on his back in the dust and digs his hands into the oil and finds, perhaps, that an electric wire has lost its point of contact. A screw tightened up again puts it back in place. Or else a strap has become distended by dampness

and has retaken its normal tension—little accidents which a professional or even an amateur who is acquainted with his vehicle ought to guess and repair in five minutes. The driver ends where he ought to have begun.

Generally when a motor vehicle has to "lie to" it is the fault of the driver and not of the machine. How many of these apprentice drivers have we seen stopped in the middle of the road to Versailles or St. Germain, waiting in despair for a colleague to come and draw them out of their embarrassment. And very often the latter puts things back in place with one simple twist of the wrist which has no magic at all about it, and you see them both start on again side by side. So it is not the machine which is defective, but the driver, who is ignorant of its management.

After "heaving to" several times, the driver begins to reflect, he decides rather late to have some practical man explain to him the use of each organ and the method of assuring himself before the start of its proper working, etc. The giving out of the motive power is disagreeable and becomes a great bore; overturning in a ditch is dangerous, sometimes causing death, as we have too often seen. To avoid these the important thing, above all else, is to assure yourself, at the start and in the course of your trip, that the brakes work properly and that you are absolute master of the steering apparatus. Improper working of these parts is the principal cause of accident. The brakes are at least two in number, one a hand-brake acting on the rims of the wheels, and the least effective of the two. It has the special inconvenience of not always gripping both wheels with equal tightness, and so if one is rushing down an incline and the hub-brakes or those of the axle of the differential do not work, there is no other recourse but to the hand-brake, which, as it does not act with equal strength on both wheels, brings about a somersault and a tumble. This accident happens especially on smooth, wet and hilly roads. Do not start out, then, without having the brakes well regulated and the cords, chains and levers in good condition.

However, to block the wheels completely with the brakes when descending a hill at full speed would be to expose one's self to certain destruction. A carriage should not be stopped suddenly any more than a rapidly moving railway train; the brakes must be used progressively, otherwise the remedy is worse than the evil.

Crouch Automobile Co. in New Quarters.

This company recently organized at Baltimore, Md., to manufacture the Crouch steam carriage, has leased a large building admirably adapted to the business, at the corner of North avenue and Oak street. The building is 125x100 feet, three stories and basement. Machinery is being put in place to turn out carriages in quantities, and the first lot of the new model will be finished early in September.

The new engines will have two cylinders but a single crank and a single eccentric operating all the valves and giving a reverse. The eccentric will be controlled by an elliptic gear giving wide open parts in cutting off short. The cylinders will be 2½x4 and the gear will be lower, bringing the speed down to a maximum of 12 to 15 miles an hour. The present engines are unnecessarily powerful, being capable of developing as high as 17 h.p.

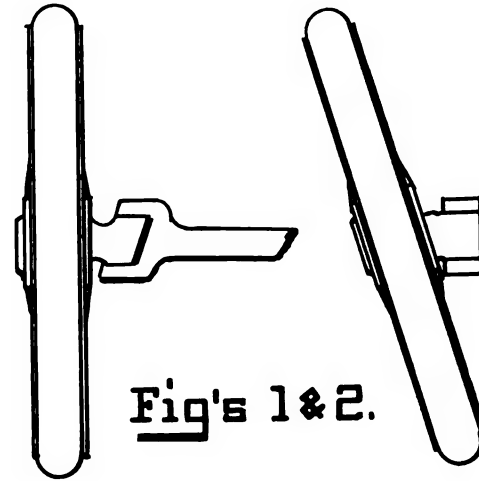
Steering Fork Angles.

By Harry F. Dey.

One of the troublesome problems met in the designing of a motor carriage is the steering fork. One not in practice usually has to ponder over it for some time before "catching on" and then it is a "cut and try" method (by figures), to get the angle of fork for any special angle of wheel. With a table the result may be arrived at in a few seconds, and believing that such will fill a "long felt want," I have made careful calculations for the accompanying tables. The pivoted hub has now come into almost universal use, some placing the pivot as close to the hub as possible, others in the theoretically correct place, that is, in the centre of the hub, which the writer thinks will finally be the universal method, as this prevents all vibration of the handle, is safer and under better control, and does not require any device for preventing the wheels from turning when striking an obstruction. In fact, a device for preventing wheels from taking their own course is objectionable, as in following a car track or rut it is desirable to let the wheel select its own way and thus avoid side wear on the tire, and end thrust friction. The only objection to this method of pivoting, known to the writer, is the large hub required. A device claimed to give the same results is to have the pivot as first described, but let it slant down in the direction of the tire, Fig. 1, the centre line projected meeting the middle of the tire on the ground, but one great objection to this is that when turned the outside wheel is tipped at an angle which has a tendency to crush over, Fig. 2. It is unmechanical, at least, if not dangerous. The inside wheel is also tipped, but in a direction which is favorable. In fact, it is well to give both pivots a slight pitch forward, similar to the rake of a bicycle. The wheels are then braced when turning, and are also more easily brought back to the normal position, while a backward pitch has the opposite effect.

Fig. 3 is a view of the usual arrangement for steering, but several recent vehicles have been using an arrangement like Fig. 4. This last method or a combination of the two, Fig. 5, has to be used where the pivots are inside the hubs. It is also well to use this combination when the difference of angle of the wheels is very large. By an inspection of Fig. 6 it will be seen that when turning, the inside wheel is in advance of the outer. Lines drawn at right angles from each of the four wheels should have a common centre. To accomplish this the rod connecting the two steering levers *a* and *b*, Fig. 3, is divided at the centre and attached to the arms of the fork *c d*. When the fork is turned in either direction the arm connected to the rod of the outer wheel is approaching a "dead centre," while the other is acting direct; consequently, the latter moves its wheel a greater angular distance than the other, the inside wheel turning the most. When the fork is turned in the opposite direction the effect on the wheels is reversed, thus meeting the opposite conditions. They will not be at their exact relative position during the whole movement, but if the extremes are correct the means will at no time be very far out of the way.

The proper relative angles of the two wheels depends on the length of wheel base and the distance between the pivots, and is governed by the angle of the fork. The first table gives the proper angles of the outer wheel when the inside



Fig's 1 & 2.

one is at 45° for the various dimensions. The inside wheel may be safely turned to about 51° , but 45° is a more satisfactory point from which to base calculations for those that turn more or less than that.

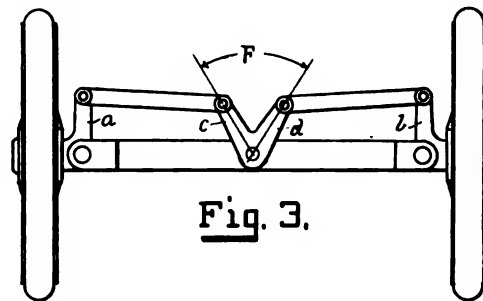


Fig. 3.

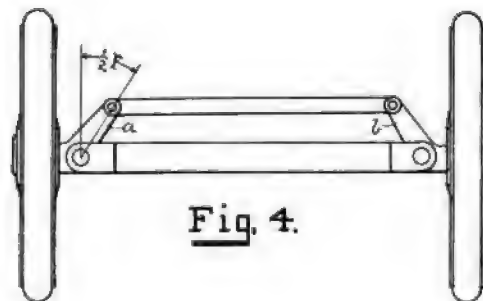


Fig. 4.

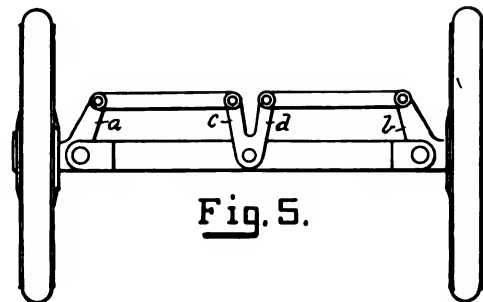


Fig. 5.

CORRECT ANGLES FOR OUTER WHEEL, WHEN INSIDE ONE IS AT 45. FOR VARIOUS LENGTHS OF WHEEL BASE AND WIDTH BETWEEN PIVOTS.															
BETWEEN PIVOTS.															
WHEEL BASE	36	38	40	42	44	46	48	50	52	54	56	58	60	62	72
54	31.20	30.47	30.15	29.45	29.15	28.46	28.18	27.51	27.24	26.59	26.34	26.10	25.46	25.23	25.38
58	31.40	31.08	30.37	30.07	29.37	29.08	28.41	28.14	27.47	27.23	26.58	26.34	26.10	25.47	25.23
60	32.00	31.29	30.58	30.28	29.59	29.30	29.02	28.36	28.10	27.45	27.21	26.57	26.34	25.71	25.48
62	32.19	31.49	31.18	30.48	30.19	29.51	29.24	28.58	28.32	27.68	27.44	27.20	26.57	25.94	25.71
64	32.37	32.07	31.37	31.08	30.39	30.11	29.44	29.19	28.54	27.90	27.66	27.42	26.79	26.16	25.93
66	32.54	32.24	31.54	31.25	30.56	30.28	30.01	29.36	29.11	28.47	28.23	27.99	27.36	26.73	26.50
68	33.10	32.41	32.12	31.44	31.16	30.49	30.22	29.57	29.32	28.69	28.45	28.21	27.58	26.95	26.72
70	33.27	32.57	32.28	32.00	31.34	31.07	30.40	30.15	29.51	28.87	28.63	28.39	27.76	27.13	26.90
72	33.41	33.12	32.44	32.17	31.50	31.24	30.58	30.33	29.69	29.45	29.21	28.97	28.34	27.71	27.48
74	33.56	33.27	32.59	32.32	32.06	31.40	31.14	30.50	30.26	29.62	29.39	29.16	28.54	27.91	27.68
76	34.10	33.42	33.14	32.47	32.21	31.55	31.30	31.06	30.42	30.19	29.56	29.33	28.71	28.08	27.85
78	34.23	33.55	33.28	33.02	32.36	32.10	31.46	31.21	30.58	30.35	30.12	29.50	28.88	28.25	28.02
80	34.36	33.68	33.41	33.15	32.50	32.25	32.00	31.37	31.13	30.51	30.28	30.06	29.45	28.82	28.59
82	34.48	33.81	33.55	33.29	32.64	32.39	32.15	31.51	31.28	30.67	30.44	30.21	29.61	28.98	28.75
84	34.60	33.93	33.67	33.42	32.77	32.52	32.28	31.65	31.42	30.81	30.58	30.35	29.75	29.12	28.89
86	34.71	34.05	33.79	33.54	32.89	32.64	32.41	31.78	31.55	30.95	30.72	30.50	29.90	29.27	29.04
88	34.82	34.17	33.91	33.66	33.01	32.76	32.53	31.90	31.67	31.07	30.84	30.62	30.02	29.39	29.16
90	34.93	34.28	34.02	33.77	33.12	32.87	32.64	32.01	31.78	31.18	30.95	30.73	30.13	29.50	29.27
92	35.04	34.39	34.13	33.88	33.23	32.98	32.75	32.12	31.89	31.29	31.06	30.84	30.24	29.61	29.38
94	35.15	34.50	34.24	33.99	33.34	33.09	32.86	32.23	32.00	31.40	31.17	30.95	30.35	29.72	29.49
96	35.26	34.61	34.35	34.10	33.45	33.20	32.97	32.34	32.11	31.51	31.28	31.06	30.46	29.83	29.60
100	35.37	34.72	34.46	34.21	33.56	33.31	33.08	32.45	32.22	31.62	31.39	31.17	30.57	29.94	29.71
104	35.48	34.83	34.57	34.32	33.67	33.42	33.19	32.56	32.33	31.73	31.50	31.28	30.68	30.05	29.82
108	35.59	34.94	34.68	34.43	33.78	33.53	33.30	32.67	32.44	31.84	31.61	31.39	30.79	30.16	29.93
112	35.70	35.05	34.79	34.54	33.89	33.64	33.41	32.78	32.55	31.95	31.72	31.50	30.90	30.27	30.04
116	35.81	35.16	34.90	34.65	34.00	33.75	33.52	32.89	32.66	32.06	31.83	31.61	31.01	30.38	30.15
120	35.92	35.27	35.01	34.76	34.11	33.86	33.63	33.00	32.77	32.17	31.94	31.72	31.12	30.49	30.26
124	36.03	35.38	35.12	34.87	34.22	33.97	33.74	33.11	32.88	32.28	32.05	31.83	31.23	30.60	30.37
128	36.14	35.49	35.23	34.98	34.33	34.08	33.85	33.22	32.99	32.39	32.16	31.94	31.34	30.71	30.48
132	36.25	35.60	35.34	35.09	34.44	34.19	33.96	33.33	33.10	32.50	32.27	32.05	31.45	30.82	30.59
136	36.36	35.71	35.45	35.20	34.55	34.30	34.07	33.44	33.21	32.61	32.38	32.16	31.56	30.93	30.70
140	36.47	35.82	35.56	35.31	34.66	34.41	34.18	33.55	33.32	32.72	32.49	32.27	31.67	31.04	30.81
144	36.58	35.93	35.67	35.42	34.77	34.52	34.29	33.66	33.43	32.83	32.60	32.38	31.78	31.15	30.92
148	36.69	36.04	35.78	35.53	34.88	34.63	34.40	33.77	33.54	32.94	32.71	32.49	31.89	31.26	31.03
152	36.80	36.15	35.89	35.64	35.00	34.75	34.52	33.89	33.66	33.06	32.83	32.61	32.01	31.38	31.15
156	36.91	36.26	36.00	35.75	35.11	34.86	34.63	34.00	33.77	33.17	32.94	32.72	32.12	31.49	31.26
160	37.02	36.37	36.11	35.86	35.22	34.97	34.74	34.11	33.88	33.28	33.05	32.83	32.23	31.60	31.37
164	37.13	36.48	36.22	35.97	35.33	35.08	34.85	34.22	33.99	33.39	33.16	32.94	32.34	31.71	31.48
168	37.24	36.59	36.33	36.08	35.44	35.19	34.96	34.33	34.10	33.50	33.27	33.05	32.45	31.82	31.59
172	37.35	36.70	36.44	36.19	35.55	35.30	35.07	34.44	34.21	33.61	33.38	33.16	32.56	31.93	31.70
176	37.46	36.81	36.55	36.30	35.66	35.41	35.18	34.55	34.32	33.72	33.49	33.27	32.67	32.04	31.81
180	37.57	36.92	36.66	36.41	35.77	35.52	35.29	34.66	34.43	33.83	33.60	33.38	32.78	32.15	31.92

ANGLE OF OUTER WHEEL PRODUCED BY FORKS COMPUTED BY

SPREAD OF FORK	ANGLE OF WHEEL	SPREAD OF FORK	ANGLE OF WHEEL	SPREAD OF FORK	ANGLE OF WHEEL	SPREAD OF FORK	ANGLE OF WHEEL	SPREAD OF FORK	ANGLE OF WHEEL	SPREAD OF FORK	ANGLE OF WHEEL	SPREAD OF FORK	ANGLE OF WHEEL	SPREAD OF FORK	ANGLE OF WHEEL
20.00	38.06	23.00	37.12	26.00	36.19	29.00	35.28	32.00	34.38	35.00	33.48	38.00	32.58	41.00	
20.04	38.04	23.04	37.11	26.04	36.18	29.04	35.27	32.04	34.37	35.04	33.47	38.04	32.57	41.04	
20.08	38.03	23.08	37.10	26.08	36.17	29.08	35.26	32.08	34.36	35.08	33.46	38.08	32.56	41.08	
20.12	38.02	23.12	37.09	26.12	36.16	29.12	35.25	32.12	34.35	35.12	33.45	38.12	32.55	41.12	
20.16	38.01	23.16	37.08	26.16	36.15	29.16	35.24	32.16	34.34	35.16	33.44	38.16	32.54	41.16	
20.20	38.00	23.20	37.07	26.20	36.14	29.20	35.23	32.20	34.33	35.20	33.43	38.20	32.53	41.20	
20.24	37.59	23.24	37.05	26.24	36.13	29.24	35.22	32.24	34.31	35.24	33.41	38.24	32.51	41.24	
20.28	37.58	23.28	37.04	26.28	36.12	29.28	35.21	32.28	34.30	35.28	33.40	38.28	32.50	41.28	
20.32	37.56	23.32	37.03	26.32	36.11	29.32	35.20	32.32	34.29	35.32	33.39	38.32	32.49	41.32	
20.36	37.55	23.36	37.02	26.36	36.09	29.36	35.19	32.36	34.28	35.36	33.38	38.36	32.48	41.36	
20.40	37.53	23.40	37.00	26.40	36.08	29.40	35.17	32.40	34.27	35.40	33.37	38.40	32.47	41.40	
20.44	37.52	23.44	36.59	26.44	36.07	29.44	35.16	32.44	34.25	35.44	33.36	38.44	32.46	41.44	
20.48	37.51	23.48	36.58	26.48	36.06	29.48	35.15	32.48	34.24	35.48	33.34	38.48	32.45	41.48	
20.52	37.50	23.52	36.57	26.52	36.05	29.52	35.14	32.52	34.23	35.52	33.33	38.52	32.43	41.52	
20.56	37.49	23.56	36.56	26.56	36.04	29.56	35.13	32.56	34.22	35.56	33.32	38.56	32.42	41.56	
21.00	37.48	24.00	36.55	27.00	36.03	30.00	35.12	33.00	34.21	36.00	33.31	39.00	32.41	42.00	
21.04	37.46	24.04	36.54	27.04	36.02	30.04	35.11	33.04	34.20	36.04	33.30	39.04	32.40	42.04	
21.08	37.45	24.08	36.53	27.08	36.01	30.08	35.10	33.08	34.19	36.08	33.29	39.08	32.39	42.08	
21.12	37.44	24.12	36.51	27.12	36.00	30.12	35.08	33.12	34.18	36.12	33.28	39.12	32.38	42.12	
21.16	37.42	24.16	36.50	27.16	35.59	30.16	35.07	33.16	34.17	36.16	33.27	39.16	32.37	42.16	
21.20	37.41	24.20	36.49	27.20	35.57	30.20	35.06	33.20	34.16	36.20	33.26	39.20	32.36	42.20	
21.24	37.39	24.24	36.47	27.24	35.56	30.24	35.05	33.24	34.14	36.24	33.25	39.24	32.35	42.24	
21.28	37.38	24.28	36.46	27.28	35.55	30.28	35.04	33.28	34.13	36.28	33.24	39.28	32.34	42.28	
21.32	37.37	24.32	36.45	27.32	35.53	30.32	35.02	33.32	34.12	36.32	33.22	39.32	32.33	42.32	
21.36	37.36	24.36	36.44	27.36	35.52	30.36	35.01	33.36	34.11	36.36	33.21	39.36	32.31	42.36	
21.40	37.35	24.40	36.42	27.40	35.51	30.40	35.00	33.40	34.10	36.40	33.20	39.40	32.30	42.40	
21.44	37.34	24.44	36.41	27.44	35.50	30.44	34.99	33.44	34.09	36.44	33.19	39.44	32.29	42.44	
21.48	37.33	24.48	36.40	27.48	35.49	30.48	34.98	33.48	34.08	36.48	33.18	39.48	32.28	42.48	
21.52	37.32	24.52	36.39	27.52	35.48	30.52	34.97	33.52	34.06	36.52	33.16	39.52	32.27	42.52	
21.56	37.31	24.56	36.38	27.56	35.47	30.56	34.96	33.56	34.05	36.56	33.15	39.56	32.26	42.56	
22.00	37.30	25.00	36.37	28.00	35.46	31.00	34.95	34.00	34.04	37.00	33.14	40.00	32.25	43.00	
22.04	37.29	25.04	36.36	28.04	35.45	31.04	34.94	34.04	34.03	37.04	33.13	40.04	32.24	43.04	
22.08	37.28	25.08	36.35	28.08	35.44	31.08	34.93	34.08	34.02	37.08	33.12	40.08	32.23	43.08	
22.12	37.26	25.12	36.33	28.12	35.43	31.12	34.92	34.12	34.01	37.12	33.11	40.12	32.22	43.12	
22.16	37.25	25.16	36.32	28.16	35.41	31.16	34.91	34.16	34.00	37.16	33.10	40.16	32.21	43.16	
22.20	37.23	25.20	36.31	28.20	35.40	31.20	34.90	34.20	33.99	37.20	33.09	40.20	32.20	43.20	
22.24	37.22	25.24	36.30	28.24	35.39	31.24	34.89	34.24	33.98	37.24	33.08	40.24	32.19	43.24	
22.28	37.21	25.28	36.29	28.28	35.38	31.28	34.88	34.28	33.97	37.28	33.07	40.28	32.18	43.28	
22.32	37.20	25.32	36.28	28.32	35.36	31.32	34.87	34.32	33.96	37.32	33.06	40.32	32.16	43.32	
22.36	37.19	25.36	36.27	28.36	35.35	31.36	34.86	34.36	33.95	37.36	33.05	40.36	32.15	43.36	
22.40	37.18	25.40	36.26	28.40	35.34	31.40	34.85	34.40	33.94	37.40	33.04	40.40	32.14	43.40	
22.44	37.17	25.44	36.25	28.44	35.33	31.44	34.84	34.44	33.93	37.44	33.03	40.44	32.12	43.44	
22.48	37.16	25.48	36.23	28.48	35.32	31.48	34.83	34.48	33.92	37.48	33.02	40.48	32.11	43.48	
22.52	37.15	25.52	36.22	28.52	35.31	31.52	34.82	34.52	33.91	37.52	33.01	40.52	32.10	43.52	
22.56	37.14	25.56	36.20	28.56	35.30	31.56	34.81	34.56	33.90	37.56	33.00	40.56	32.09	43.56	

OF VARIOUS ANGLES, WHEN INSIDE ONE IS AT 45° HARRY E. DEY.

ANGLE OF WHEEL	SPREAD OF FORK	ANGLE OF WHEEL	SPREAD OF FORK	ANGLE OF WHEEL	SPREAD OF FORK	ANGLE OF WHEEL	SPREAD OF FORK	ANGLE OF WHEEL	SPREAD OF FORK	ANGLE OF WHEEL	SPREAD OF FORK	ANGLE OF WHEEL	SPREAD OF FORK	ANGLE OF WHEEL	SPREAD OF FORK
32.08	44.00	31.18	47.00	30.29	50.00	29.39	53.00	28.48	56.00	27.57	59.00	27.05	62.00	26.13	
32.07	44.04	31.17	47.04	30.28	50.04	29.38	53.04	28.47	56.04	27.56	59.04	27.04	62.04	26.11	
32.06	44.08	31.16	47.08	30.27	50.08	29.37	53.08	28.46	56.08	27.55	59.08	27.03	62.08	26.10	
32.05	44.12	31.15	47.12	30.26	50.12	29.36	53.12	28.45	56.12	27.54	59.12	27.02	62.12	26.09	
32.03	44.16	31.14	47.16	30.25	50.16	29.35	53.16	28.43	56.16	27.53	59.16	27.00	62.16	26.08	
32.02	44.20	31.13	47.20	30.24	50.20	29.34	53.20	28.42	56.20	27.51	59.20	26.99	62.20	26.07	
32.01	44.24	31.12	47.24	30.22	50.24	29.32	53.24	28.41	56.24	27.50	59.24	26.98	62.24	26.05	
32.00	44.28	31.11	47.28	30.21	50.28	29.31	53.28	28.40	56.28	27.49	59.28	26.97	62.28	26.04	
31.99	44.32	31.10	47.32	30.20	50.32	29.30	53.32	28.39	56.32	27.48	59.32	26.96	62.32	26.03	
31.98	44.36	31.09	47.36	30.19	50.36	29.29	53.36	28.38	56.36	27.47	59.36	26.95	62.36	26.02	
31.97	44.40	31.08	47.40	30.18	50.40	29.28	53.40	28.37	56.40	27.46	59.40	26.94	62.40	26.01	
31.96	44.44	31.07	47.44	30.17	50.44	29.26	53.44	28.36	56.44	27.44	59.44	26.93	62.44	25.99	
31.95	44.48	31.06	47.48	30.16	50.48	29.25	53.48	28.35	56.48	27.43	59.48	26.92	62.48	25.98	
31.94	44.52	31.05	47.52	30.15	50.52	29.24	53.52	28.34	56.52	27.42	59.52	26.91	62.52	25.97	
31.92	44.56	31.03	47.56	30.14	50.56	29.23	53.56	28.32	56.56	27.40	59.56	26.90	62.56	25.95	
31.91	45.00	31.02	48.00	30.13	51.00	29.22	54.00	28.31	57.00	27.39	60.00	26.89	63.00	25.94	
31.90	45.04	31.01	48.04	30.11	51.04	29.21	54.04	28.30	57.04	27.38	60.04	26.88	63.04	25.93	
31.89	45.08	31.00	48.08	30.10	51.08	29.20	54.08	28.29	57.08	27.37	60.08	26.87	63.08	25.92	
31.88	45.12	30.99	48.12	30.09	51.12	29.18	54.12	28.28	57.12	27.36	60.12	26.86	63.12	25.91	
31.87	45.16	30.98	48.16	30.08	51.16	29.17	54.16	28.27	57.16	27.35	60.16	26.85	63.16	25.90	
31.86	45.20	30.97	48.20	30.07	51.20	29.16	54.20	28.26	57.20	27.34	60.20	26.84	63.20	25.89	
31.85	45.24	30.96	48.24	30.06	51.24	29.15	54.24	28.25	57.24	27.32	60.24	26.83	63.24	25.88	
31.84	45.28	30.95	48.28	30.05	51.28	29.14	54.28	28.24	57.28	27.31	60.28	26.82	63.28	25.87	
31.83	45.32	30.94	48.32	30.04	51.32	29.13	54.32	28.23	57.32	27.30	60.32	26.81	63.32	25.86	
31.82	45.36	30.92	48.36	30.03	51.36	29.11	54.36	28.21	57.36	27.29	60.36	26.80	63.36	25.85	
31.81	45.40	30.91	48.40	30.01	51.40	29.10	54.40	28.20	57.40	27.28	60.40	26.79	63.40	25.84	
31.80	45.44	30.90	48.44	30.00	51.44	29.09	54.44	28.19	57.44	27.27	60.44	26.78	63.44	25.83	
31.79	45.48	30.89	48.48	29.99	51.48	29.08	54.48	28.18	57.48	27.26	60.48	26.77	63.48	25.82	
31.78	45.52	30.88	48.52	29.98	51.52	29.07	54.52	28.17	57.52	27.25	60.52	26.76	63.52	25.81	
31.77	45.56	30.87	48.56	29.97	51.56	29.06	54.56	28.15	57.56	27.24	60.56	26.75	63.56	25.80	
31.76	46.00	30.86	49.00	29.95	52.00	29.05	55.00	28.14	58.00	27.22	61.00	26.74	64.00	25.79	
31.75	46.04	30.85	49.04	29.94	52.04	29.04	55.04	28.13	58.04	27.21	61.04	26.73	64.04	25.78	
31.74	46.08	30.84	49.08	29.93	52.08	29.03	55.08	28.12	58.08	27.20	61.08	26.72	64.08	25.77	
31.73	46.12	30.83	49.12	29.92	52.12	29.02	55.12	28.11	58.12	27.19	61.12	26.71	64.12	25.76	
31.72	46.16	30.82	49.16	29.91	52.16	29.01	55.16	28.10	58.16	27.18	61.16	26.70	64.16	25.75	
31.71	46.20	30.81	49.20	29.90	52.20	29.00	55.20	28.09	58.20	27.16	61.20	26.69	64.20	25.74	
31.70	46.24	30.80	49.24	29.89	52.24	28.99	55.24	28.08	58.24	27.15	61.24	26.68	64.24	25.73	
31.69	46.28	30.79	49.28	29.88	52.28	28.98	55.28	28.07	58.28	27.14	61.28	26.67	64.28	25.72	
31.68	46.32	30.78	49.32	29.87	52.32	28.97	55.32	28.06	58.32	27.13	61.32	26.66	64.32	25.71	
31.67	46.36	30.77	49.36	29.86	52.36	28.96	55.36	28.05	58.36	27.12	61.36	26.65	64.36	25.70	
31.66	46.40	30.76	49.40	29.85	52.40	28.95	55.40	28.04	58.40	27.11	61.40	26.64	64.40	25.69	
31.65	46.44	30.75	49.44	29.84	52.44	28.94	55.44	28.03	58.44	27.10	61.44	26.63	64.44	25.68	
31.64	46.48	30.74	49.48	29.83	52.48	28.93	55.48	28.02	58.48	27.09	61.48	26.62	64.48	25.67	
31.63	46.52	30.73	49.52	29.82	52.52	28.92	55.52	28.01	58.52	27.08	61.52	26.61	64.52	25.66	
31.62	46.56	30.72	49.56	29.81	52.56	28.91	55.56	28.00	58.56	27.07	61.56	26.60	64.56	25.65	
31.61	47.00	30.71	50.00	29.80	53.00	28.90	56.00	27.99	59.00	27.06	62.00	26.59	65.00	25.64	

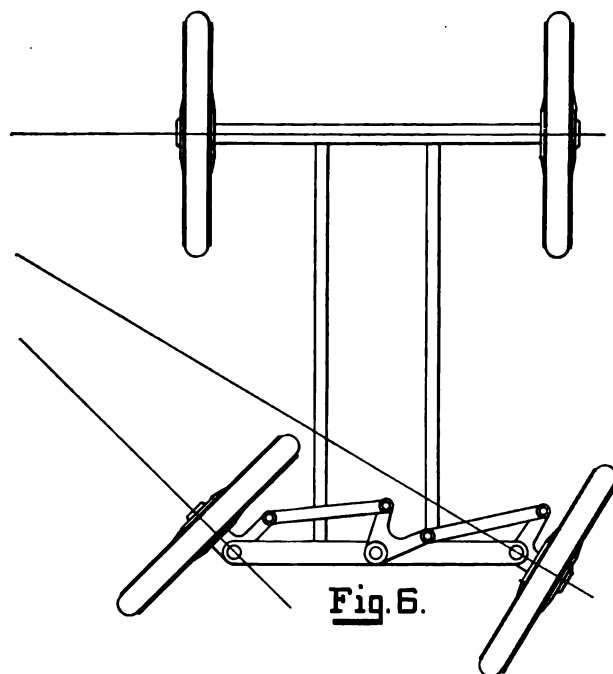
The second table gives the angles the fork should have to give the required difference found in the first table. The tables are calculated by the following formulas: For the first table let B =wheel base, W =width between pivots, O =angle of outer

wheel, then $\frac{B}{B+W} = \tan. O$. This formula is only applicable

when the inside wheel is 45° . For the second table let F =angle of fork, M =angle of fork movement, O =angle of outer wheel, C =angle that arm passes beyond centre, then

$\sin, 45^\circ - \sin, \frac{F}{2} = \sin. C$. $C + \frac{F}{2} = M$. $\sin, \frac{F}{2} + M = \sin. \frac{F}{2}$
 $= \sin. O$, F has to be assumed, and if one is after some special wheel angle, it is "cut and try" until the proper one is found.

To use the table find the proper angle the outer wheel should have, which is at the intersection of the columns, "wheel base," and "distance between pivots," then turn to the other table and find the proper fork corresponding with the outside wheel angle thus found. For example, suppose we have a vehicle of six feet wheel base and fifty inches between



pivots. In the first table we find $30^\circ 33'$ is at the intersection of the above mentioned columns. Turning to the second table we find $46^\circ 44'$ for the spread of fork corresponding with a movement of the outer wheel of $30^\circ 33'$.

It should be borne in mind that all four arms must be of the same length and those attached to the hubs must be at right angles to their axes.

In Fig. 4 the conditions are exactly reversed, the nearer an arm is to a dead centre the greater the angular movement, the angles of the arms a and b correspond to those of the fork arms c and d , the sum of the two being equal to the spread of the fork, and are taken from the tables in the same manner.

Do not use the table for Fig. 5. One might suppose from a casual observation that a fork angle that would produce one-half the angular variation of the wheels, and a and b each having an angle one-half the fork that the combined result would be twice that of either one singly, but this is

not so. The writer does not know of any direct formula by which this can be calculated, the only way apparent being to assume the angles for F and $\frac{1}{2} F$ (or other proportions if desired), and then find by calculation the result produced, and keep on trying until the desired angles are obtained. The following is the writer's method of testing:

Let F = fork angle and $\frac{1}{2} F$ = angle of arms, a and b , and base our calculations as before on a movement of the inside wheel of 45° . Then $\sin. (\frac{1}{2} F + 45^\circ) - \sin. \frac{1}{2} F$ = horizontal movement of arm, connecting a and b , which we

will call H , then $H - \sin. \frac{F}{2} = \sin. C$, C being the angle that

arm c passes beyond centre, $C + \frac{F}{2}$ = angular movement of

fork, $C + \frac{F}{2} + \frac{F}{2} = C + F$ = extreme angle d reaches from

centre, $\sin. (C + F) - \sin. \frac{F}{2} = H'$, or horizontal movement

of rod connecting d and b . $H' - \sin. \frac{1}{2} F = \sin. O$, or angle b passes centre $O + \frac{1}{2} F$ = angle of movement outer wheel example. Let $F = 20^\circ$ and $\frac{1}{2} F = 10^\circ$, then $\frac{1}{2} F + 45^\circ = 55^\circ$. $\sin. 55^\circ - \sin. 10^\circ = .8192 - .1736 = .6456 = H$. $.6456 - .1736 = .4720 = 28^\circ 10' = C$. $28^\circ 10' + 10^\circ = 38^\circ 10'$ = angular movement of fork. $28^\circ 10' + 20^\circ = 48^\circ 10' = C + F = .7451$. $.7451 - .1736 = .5715 = H'$. $.5715 - .1736 = .3979 = 23^\circ 27' = O$, $23^\circ 27' + 10^\circ = 33^\circ 27'$ = angle of outer wheel. The gauge of the vehicle does not in any manner affect the calculations, the distances between axles and between pivot are the only factors.

Perhaps a few words in regard to the gauge of vehicles may not be amiss here. The standard street car gauge is 4.7 feet, approximately 4 feet 8½ inches; the average horse vehicle is built to measure 4 feet 8 inches outside, so as to run easily inside a car track. Many motor vehicle designers make the mistake of measuring to the centre of the tire. The writer does not know that there is any particular disadvantage in it, except that they do not accomplish the object they have in view of conforming to horse carriage gauge, as for the track, it is hardly suitable for the wide tires on most motor vehicles.

The Pender Australian Carriage.

John Pender, Brunswick, Victoria, Australia, is building a gasoline carriage for the Paris Exposition of 1900.

The motor has two pistons working in one cylinder, thus reducing vibration. The transmission, which can be attached to the crank pin of the motor at one end and connected to the axle at the other, consists of six links and a clutch. By arranging these links or levers any variation of speed can be given to the axle of the vehicle while the motor is working at constant speed. No sprocket wheels, chains, belts or gears are employed.

TRAINING SCHOOL FOR MOTORMEN.

The Automobile Chamber of Paris has started a school for motormen, naming as a committee to draft a plan M. Jeantaud, the well-known carriage builder; M. Pozzi, manufacturer of springs and axles, and M. Chauveau. The direction of the school will fall to M. Chauveau. Lessons will be given in driving and in the practical care and management of motor vehicles.

The Lewis Gasoline Vehicles.

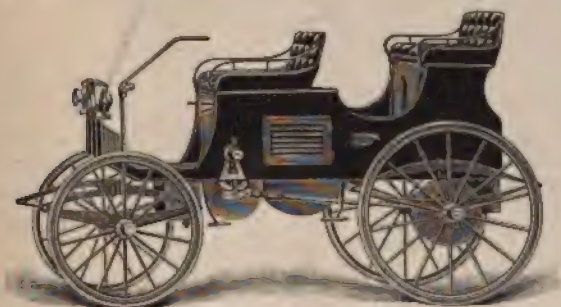
The development of the Lewis motor vehicles at Philadelphia has been delayed by the illness of the president, Walter E. Graham, who was confined to his bed for eleven weeks with typhoid fever and only recently took the helm again. Since his return, however, operations have been pushed with energy. Three factory buildings on Canal St. have been purchased by the company, one of six, a second of five and a third of four stories, affording facilities for 1,000 men, if required.



SINGLE SEAT LEWIS CARRIAGE.

In their present perfected form the Lewis vehicles are distinguished chiefly by their horizontal single-cylinder engine and friction transmission. The engine, which Mr. Lewis calls a straight line, has a 7-inch stroke and 6-inch bore and weighs 350 lbs. The gasoline is fed to the cylinder by gravity, being automatically controlled by the governor through suction of the air, the amount of which, admitted, is varied according to the work done. As the amount of air used increases the amount of vapor taken in within increases in the same proportion, the mixture being always uniform.

The electric spark is employed to fire the charge, the time of the ignition being varied only when starting the engine. When the vehicle is stopped the speed of the engine is reduced by closing the inlet valve, and a new method is employed to do away with vibration when the vehicle is standing still.



TWO SEAT LEWIS CARRIAGE.

The wheels have wooden spokes, metal hubs of special design and solid tires.

The most interesting features are the transmission and control of speed on which Mr. Lewis received a prize at Chicago in 1895. There are two compressed paper frictions on

the engine, two gears and two pulleys coming in contact with the frictions, giving four speeds forward and two backward, ranging from two to 12 or more miles an hour. A powerful brake is secured by means of a leather shoe in front of the driving pulley.

Perfect control is obtained by means of a treadle, so responsive that the mere weight of the foot is sufficient to drive the carriage up a steep hill. If the foot is pressed forward the vehicle goes forward, if the heel is used the vehicle goes backward.



LEWIS MOTOR DELIVERY WAGON.

No adjustment of the mixture is needed. To start the carriage the driver merely turns a stop cock and switches on and reverses the operation to stop it.

The three illustrations given show three different styles of body that are put upon substantially the same frame. The weight of these vehicles is about 1,700 lbs. The Lewis Motor Vehicle Co. will also build a 700-lb. carriage of tubing, aluminum and sheet steel.

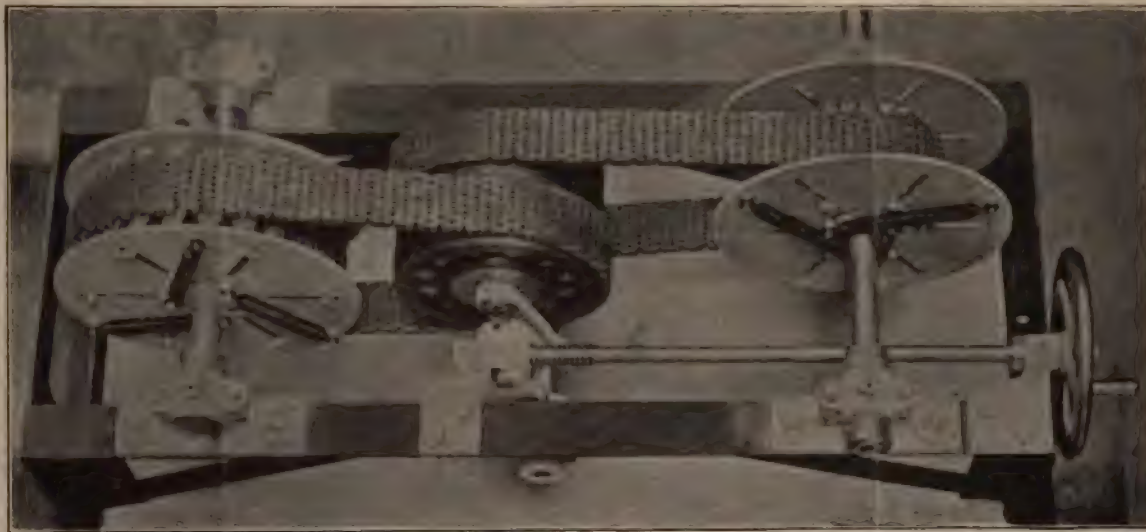
MINOR MENTION.

The Graham Equipment Co., Boston, Mass., have 10 steam carriages which they can deliver immediately. These carriages seat two or four persons, weigh 800 pounds, have Whitney boiler, engine and steering handle, carry water for 25 miles and gasoline for 100 miles. The maximum speed is 15 to 20 miles an hour, and the trucks and machinery are entirely independent of the bodies.

The Columbia Motor & Manufacturing Co. was recently chartered in Virginia, with a capital of \$5,000,000. The officers are: President, Theodore J. King; Secretary and Treasurer, A. O. Babendrere, and the Directors, Thomas Downey, W. H. Schrom and W. Cator. This company will immediately commence the manufacture and use of horseless vehicles in Washington, D. C., and elsewhere.

Millard F. Blaine and Mr. Young, of Geneva, N. Y., have been in Rochester, N. Y., looking into the merits of J. B. West's steam motor vehicle with a view to manufacturing it.

The otherwise progressive city of Rochester, N. Y., does not encourage the motor vehicle industry, as its municipal judge decided against it in court. But for this it might have had scores of such vehicles on its streets and an automobile factory, whereas now it has only two motor vehicles, one of home product and one from Cleveland, O.



LUCAS'S NEW VARIABLE SPEED GEAR.



STEAM CARRIAGE OF THE SOCIETE EUROPAENNEET AUTOMOBILES.

LONDON NOTES.

London, July 13, 1899.

A factory is about to be started at Augustendal, near Stockholm, Sweden, for the manufacture of horseless vehicles.

A report is current to the effect that the Local Government Board is considering the question of extending the permissible speed limit in England of motor vehicles weighing under two tons tare from 8 to 12 miles an hour.

The Joel Electric Carriage motor and Battery Syndicate, Ltd., of 37 Walbrook, London, E. C., as a result of their exhibit at the Paris exhibition, have secured a large contract for electric vehicles from a French concern.

In the course of an interview with C. Oppermann, of Wynyatt St., Clerken Well, E. C., at the exhibition he informs me that he had lately secured an order for 50 of his electric vehicles for service in Vienna. These will be provided with a standard tubular frame, carrying the motor and transmission gear, etc., so that any type of body may be fitted.

LIVERPOOL HEAVY MOTOR TRIALS.

The arrangements for the trials of heavy motor vehicles, organized by the Liverpool Self-Propelled Traffic Association, are now well in hand. The trials will extend from the 31st of July to Aug. 2d. The following are the entries: Class A. (minimum load, 2 tons; maximum tare, 2 tons; minimum level platform area, 50 square feet).—The Automobile

Association, Ltd., London; T. Coulthard & Co., Cooper Road, Preston; The Thornton Motor Co., Ltd., Worsley Mills, Hulme, Manchester. Class B. (minimum load, $3\frac{1}{2}$ tons; maximum tare, 3 tons; minimum level platform area, 65 square feet).—Bayleys, Ltd., Newington Causeway, S. E.; The Clarkson and Capel Steam Car Syndicate, Ltd., Devereil Street, London, S. E.; The Graham Equipment Co., 170 Summer Street, Boston, Mass., U. S. A.; The Lancashire Steam Motor Co., Leyland; Simpson and Bodman, Cornbrook, Manchester; The Steam Carriage and Wagon Co., Ltd., Homefield, Chiswick. Class C. (minimum load, 5 tons; maximum tare, 3 tons; minimum level platform area, 80 square feet).—C. & A. Musker, Ltd., Liverpool. Class D. (minimum load, $6\frac{1}{2}$ tons; maximum tare, 4 tons; minimum level platform area, 110 square feet).—The Steam Carriage and Wagon Co., Ltd., Homefield, Chiswick. It will be noticed that the list contains the name of one American firm.

Dan Albane, of Biggleswade, one of the oldest cycle makers in the country, is now engaged on the construction of a new four-seated gasoline carriage to his own designs. The motor is of the Benz horizontal type, of 3-h.p., arranged in such a way that it can be started from the driver's seat. Two speeds are provided, transmission being by means of belts and chains. The motor and transmission are all mounted on a distinct tubular frame, so that any type of carriage body may be fitted.

Great interest was evinced at the exhibition at the Agricultural Hall, Islington, on Tuesday afternoon by the arrival of Mr. Whitney, of the Whitney Steam Wagon Co., of Boston, U. S. A., on one of his steam carriages. He drove his carriage down to London by road, and in a day or two intends proceeding to France.

Another American carriage seen for the first time in England—the "Waverly Runabout"—put in an appearance this week at the exhibition. It is shown by the Automobile Association, of Notting Hill. The carriage has come in for a

large amount of admiration owing to its lightness and attractive design.



THE ROOTS KEROSENE MOTOR CARRIAGE.

Considerable interest has been aroused this week by the announcement that Messrs. De Dion-Mouton & Co., of France, are about to make their tricycle motors of $2\frac{1}{4}$ h.p. instead of only $1\frac{3}{4}$ h.p. as formerly. This new motor has been kept a secret, but it has been going through some severe tests before being adopted by De Dion-Bouton & Co. as their new standard model. It is generally stated in motor circles here that the new departure is due to the success achieved by a rival motor firm, whose motor from the first has been of $2\frac{1}{4}$ h.p.

THE "PROGRESS" GASOLINE CARRIAGE.

In a recent issue having referred to a new gasoline carriage constructed by E. West, of the Progress Cycle Co., Ltd., Foleshill, Coventry, I now inclose photos together with a few brief



THE "PROGRESS" GASOLINE CARRIAGE.



THE BLAKE TWO-SEATED MOTOR CARRIAGE.

particulars of the motor. The motor located at the rear and slightly inclined is of the vertical type, with electrical ignition, while cooling of the cylinder is accomplished by ribs of larger size than usual. The carburetor is of the Longuemare type. Two speeds are provided, controlled as is also the cutting out of the motor from the transmission gear, by a single handle on the steering standard. Two light chains transmit the power from the motor to a counter-shaft. The sprockets on which these chains work run on ball-bearings and are provided with band clutches so that either can be rigidly connected with the shaft and so made to transmit the power, the starting, by reason of the band clutches, being progressive and in no way jerky. From the counter-shaft to the rear axle the drive is by means of a central chain. The wheels are of the suspension type with pneumatic tires and the steering is by means of a hand-wheel. The carriage, which is arranged to carry two persons, weighs complete only 475 lbs., the body being unusually well suspended.

THE "CHAMPION" CARRIAGE.

The "Champion" is the name of a new light four-seated carriage which has just been put on the market here by Higgs "Champion" Carriage Syndicate, 17 Iron Monger Lane, E. C. The motor is at present a De Dion 1½ h.p., but it is intended to fit future carriages with a more powerful motor. The motor and the whole of the transmission gear is arranged under the body, so that none of the working parts are visible. The motor drives by pinions a first counter-shaft, which in turn is geared by a belt, working on fast and loose pulleys, to the rear axle. Only one speed is provided in the car exhibited, but it is intended to fit a two-speed gear

in future. The starting of the motor is effected from the front seat by means of a pedal, which terminates in a rack in gear with a ratchet wheel on the second counter-shaft. A hand-lever is provided which serves a three-fold purpose, its operation controlling simultaneously the application of a band-brake, the cutting off of the electrical ignition, and the shifting of the belt on to the loose pulley. The steering arrangement is also of a new type. The lower end of the steering rod is rigidly connected to one end of a horizontal short arm, to the other end of which is fixed a short vertical rod fitted with a roller. This short rod works in a recess formed in the lever connected to the steering wheels. Both the front and rear axles are provided with helical springs. The carriage weighs complete about 400 lbs. The wheels have wooden spokes, with solid rubber tires.

F. C. Blake, of Ravenscourt Works, Hammersmith, who has been known in the English automobile world for his electric ignition apparatus, has just completed a new light two-seated carriage, built in accordance with his own ideas. The motor is a horizontal two-cylinder one of the gasoline type; it is of 3 h.p., with water-jackets, and is located in the centre of the rear portion of the frame; its normal speed is 800 revolutions a minute. In the carriage at the exhibition the ignition is electric by means of small accumulators. It was not possible to completely finish the vehicle, as it finally will be, in time for the show. In this case, for example, Mr. Blake has only fitted the accumulators temporarily, it being intended to use an electro-magnetic device driven off the motor-shaft known as Dawson's. A carburetor of the Longuemare type is employed. Two speeds, about five and 14 miles an hour, are provided. The motor-shaft carries a



HIGG'S "CHAMPION" CARRIAGE.

drum, which is connected by a single belt to a first counter-shaft, carrying one loose and two fast pulleys. Connected to each of the fast pulleys is a pinion which gears with corresponding pulleys on a second counter-shaft. The belt-shipping lever is controlled by the foot and not by the hand as usual, this single lever being made to serve a number of purposes. The pedal works in a A slot in the floor of the carriage, and is arranged to take four different positions (1) the high speed, (2) the low gear, (3) belt on loose pulley,

motor thus running free; and (4) application of brand brake. The first counter-shaft is carried in swinging arms, the belt being continually kept taut by means of a spring. From the second counter-shaft to the rear road-wheel axle the power is transmitted by a single chain. The wheels are of the suspension type with solid rubber tires. Steering is effected by means of a hand wheel controlling the front wheels. Another feature of the vehicle is the pneumatic spring device fitted to the fore-carriage frame. This is of the compensation lever type.



THE CLIFT ELECTRIC CARRIAGE.

allowing each wheel to rise and fall independently, according to the inequalities of the road, the strain being taken up by a centrally-located pneumatic pad encased between two metal disks. The oil tank, which has a capacity of 8 gallons, is arranged in the front of the carriage, providing an additional seat for two persons. The car is started by means of a detachable handle, while all the working parts of the motor are readily accessible. The water tank is of large capacity and fitted with cooler sufficient for a day's run. The upholstery is in morocco leather, and the back of the seat is carried up high enough to make a comfortable rest. The front mudguards are fastened to the front axles and move with the wheels, so keeping mud from being splashed over the under-frame and machinery. The vehicle appears to run very quietly and with a minimum vibration. Its weight complete is about 750 lbs.



THE DARRACQ CARRIAGE (BOLLEÉ SYSTEM.)

A very neat-looking electric vehicle is the four-seated victoria which has lately been introduced by E. H. Clift, of the Sinclair Motor Works, Sinclair Road, Kensington, W. The carriage, which can be fitted with a detachable "tiger" seat at the rear, is provided with a battery of 40 accumulators arranged under the seats. The cells are of a special type, having Headland positive plates and Clift negatives; the weight of the battery is 1,200 lbs., one charge being sufficient for a run of 50 miles over ordinary roads. The battery is arranged to be recharged in situ from either a 50 or 100-volt circuit, an operation which can, if necessary, be done in two hours. The motor is of the series type, being of 3 normal h.p., but capable of working up to 6 h.p. The speed of the motor, which is reversible, is 1,200 revolutions per minute. The motor is located under the centre of the carriage, and is geared to the counter-shaft by raw-hide pinions and from the counter-shaft to the rear wheels by sprocket wheels and chains. A two-speed gear controlled by friction clutches is fitted on the counter-shaft. The controller is arranged to give three forward and three reverse speeds—4, 8 and 16 miles per hour—while an extra-special speed—18 miles—is provided, controlled by the heel of the foot, for quick manoeuvring in traffic. The wheels have wooden spokes and solid tires. Two brakes are provided—a band brake operated by a foot pedal and acting on the differential, and shoe brakes controlled by a hand lever on the rear wheels. The weight of the carriage complete is 2,500 lbs.

COMMUNICATIONS.

A Mixing Valve.

New Haven, Conn., July 17th, 1899.

Editor Horseless Age:

In regard to the communication in your July 12th issue from a party who wants a mixing valve, would say that we have a system of gasoline vaporization that is suitable for almost any engine whether built or to be built, whether a 4-cycle or a 2-cycle engine, or for a throttle or hit and miss governor.

Yours truly,

THE DENISON ELEC. ENGINEERING CO.

Water Coils and Pivoted Axles.

Baltimore, Md., July 15, 1899.

Editor Horseless Age:

In the issue of the Horseless Age just received, I note that the manufacturers of automobiles employing radiating-ribbed gasoline engines, are, according to your description in the above issue, using water coils. You would greatly oblige me by explaining the above, also by explaining the increasing popularity of the hinge wheel over the centre pivot axle. Thanking you in advance for the above information, I remain, Yours truly

CHRISTOPHER LIPPS.

ANSWER.

1. This query doubtless refers to the Daimler motors mentioned on page 10, July 12. The larger sizes of this type of motor are provided with a water-jacket and a supplementary coil to increase the amount of cooling surface in contact with the air. The smaller sizes have no provision for cooling other than radiating ribs. Of course, changes in detail are constantly being made, but believe the foregoing to be current practice.

Owing to the mechanical arrangement of this motor, a charge of cool air is introduced at every outward stroke, into the cylinders from the inclosed crank casing, which helps to prevent over-heating.

2. With ordinary adaptations the hinged steering wheels have less sensitiveness to road obstructions, combined with greater mobility; then again, the deflection from a parallel line through the rear axles, does not lessen the stability at usual speeds.

To get these conditions with the centre pivot axle is a difficult task. Several attempts have been made to adapt a locking device to the centre pivoted axle which would be rigid against obstacles struck by the wheels but permitting an easy action of the hand lever.

With one exception none of these have come into general use owing to a deficiency either in rapidity, reliability or rigidity. A couple of bevel gears worm and worm gear will serve to connect the upright steering rod and axle. This gives rigidity, but, the greater the power, the less the speed. The worm can be positively driven from motor, either by clutches or other familiar devices, but it leads to complication.

There is a general belief that, unless the angle of deflection is retained within narrow limits, the vehicle with centre pivoted axle stands upon a less trustworthy foundation than the one equipped with hinged pivots, other things being equal.

R. I. C.

OUR FOREIGN EXCHANGES.

A French Steam Dray.

The accompanying illustrations, Figs. 1, 2 and 3, show a new steam dray built by Piat & Sons, engineers of Paris. The vehicle is of metal throughout. Its principal dimensions are: Length over all, 28 ft.; wheel base, 13.6 ft.; diameter of front wheels, 3.08 ft.; diameter of rear wheels, drivers, 5.28 ft.; gauge, 6.75 and 8.13 ft.; breadth of tires, 5.9 and 7.0 in. In this vehicle the boiler is located at the rear, the mechanism being in front of it. The total weight in working order is said to be 8 tons, the usual load being between 5 and 6 tons; the speed on the level is $6\frac{1}{4}$ miles per hour. The generator,

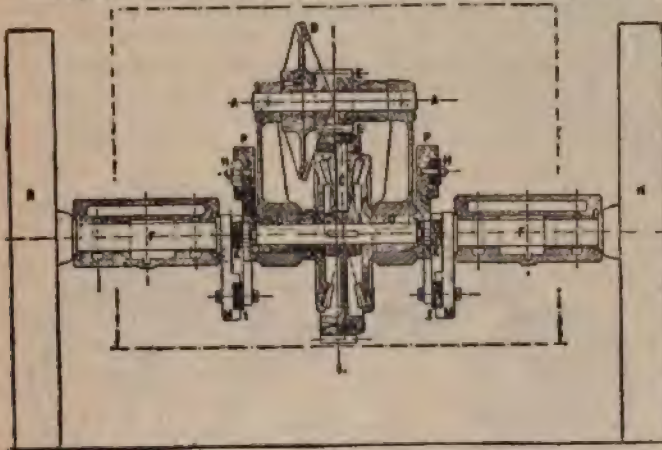


FIG. 2. SECTION THROUGH DIFFERENTIAL AXLE.

which is arranged to work with either wood, coal or coke as fuel, is of the vertical water-tube type, and carries steam at a working pressure of 142 lbs. per square inch. There are no less than 117.8 sq. ft. of heating surface, the maximum evaporation being 1,507 lbs. of steam per hour. The feed-water tank is carried under the platform, and it has a capacity of 28.6 gallons. The motor is a two-cylindrical one inclined at an angle of 45 degrees. The dimensions of the cylinders are: Diameter, 6.299 in.; stroke, 5.9 in. Steam is cut off at 65 per cent. in both cylinders. The distribution is effected by a single eccentric arranged on the Gooch system.

As will be seen from Fig. 3, the motor shaft is placed longitudinally, and is provided with two fly-wheels VV. It transmits motion through the bevel wheel B to the intermediate shaft A (Fig. 2). Upon this shaft is keyed a wheel

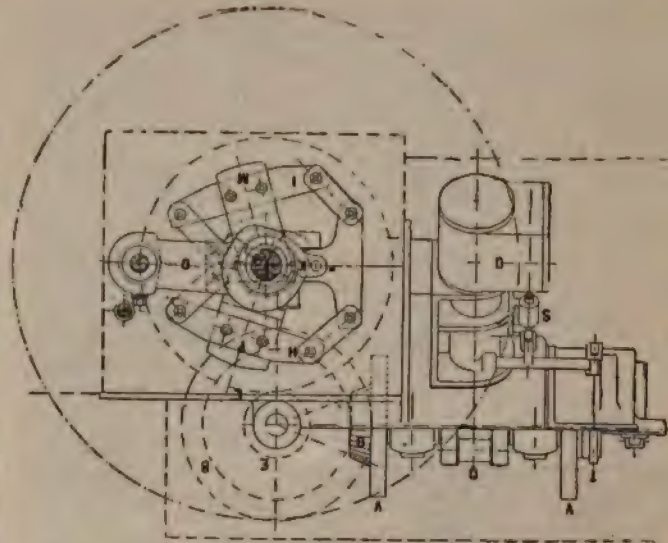


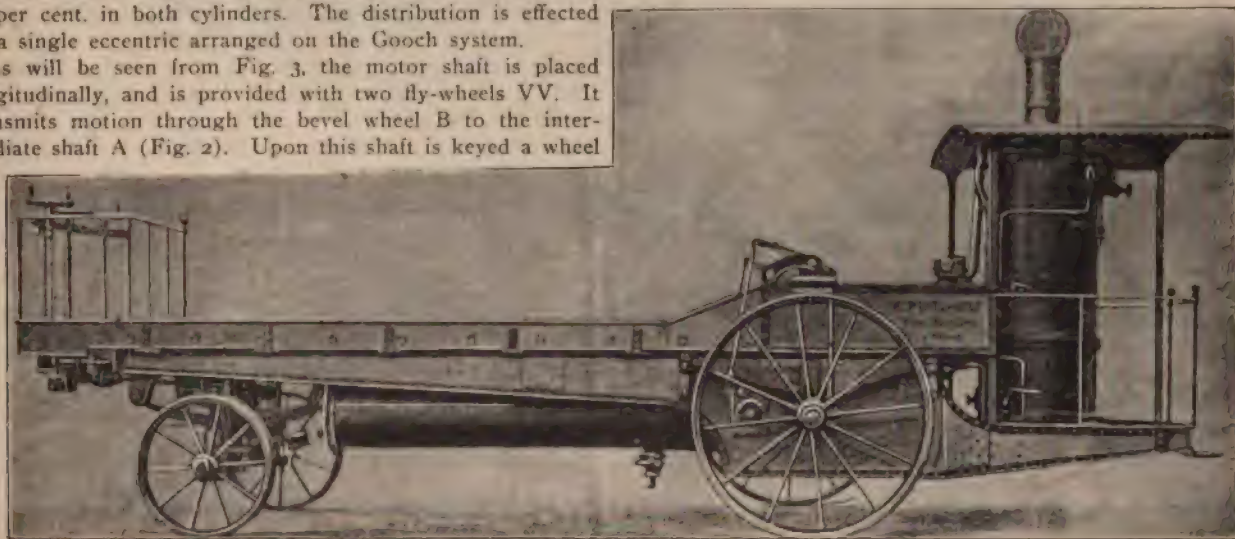
FIG. 3. DIAGRAM OF ENGINE.

E, which gears with another wheel carrying the differential C, mounted upon the driving shafts DD. To transmit the power to the rear road-wheels without using chain gear a special mechanism is employed. The road-wheels are of iron, and are keyed to their respective axles FF, which run in long axle boxes. Each axle box is attached by means of an arm to a hinged joint G (Fig. 3); between the inner ends of the shafts FF and the outer ends of the differential shafts DD is interposed an arrangement of links and disks M and I (Fig. 2), thus permitting a certain amount of vertical play to take up road vibrations due to inequalities in the roads. —*Motor Car Journal*.

Two-Speed Transmission.

This transmission, designed by R. de Metz, 11 rue Leon-Cogniet, Paris, is especially intended for light vehicles.

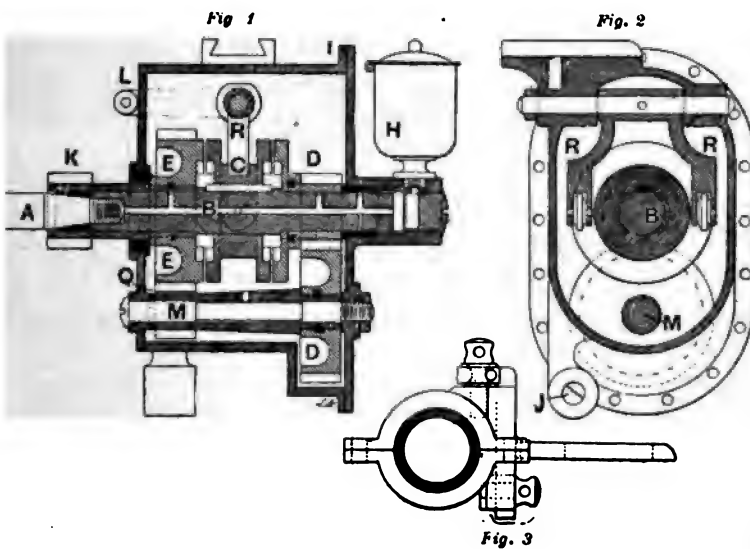
Upon the motor shaft A is screwed a shaft B, which midway carries a coupling box C, turning with the shaft but



STEAM DRAY, PIAT & SONS, PARIS, FRANCE.

movable along it. This coupling box has on each of its sides a crown of mortises and tenons which join it to two similar crowns located one to the right and the other to the left, according as the gear is thrown one way or the other.

On each side of the coupling box are two pinions each connected with a crown or clutch element. One of these pinions, D, turns idle on the shaft B, the other, E, is fast to a hollow shaft G which turns loose in the shaft B and carries the motor pinion K.



A small shaft M, parallel to the first has two pinions, D and Q, rigidly connected one with the other and gearing with the pinions D and E.

The mechanism is operated by means of a double fork R, which is controlled by a return movement through a handle acting upon the rod.

Lubrication is accomplished through the shaft B which is perforated along its axis and is supplied by the lubricator H. All the moving parts are encased in a dust proof case I, which has at J, a device for fastening the gear either upon the frame of the vehicle or on the motor itself. The small pinion K is protected by its ordinary covering.

When we throw the gear C to the left the hollow shaft and pinion K turn with the same speed as B. The gears turn idle in the box and the vehicle makes its normal speed.

When the gear C is thrown to the right the pinion D becomes fast to the motor shaft and transmits motion at half the speed to the second pinion D, solid with Q, which transmits to E again, reducing speed one-half. In consequence the pinion K rigid with E, will turn the shaft B at a speed reduced in proportion to the number of teeth in the four reducing pinions, which can be varied at the will of the maker.

When the coupling box is at its middle position the motor is not connected with the mechanism.

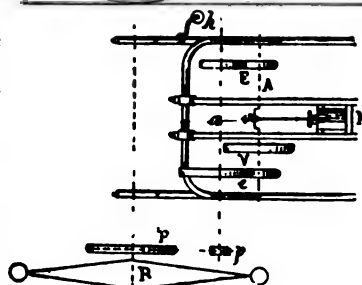
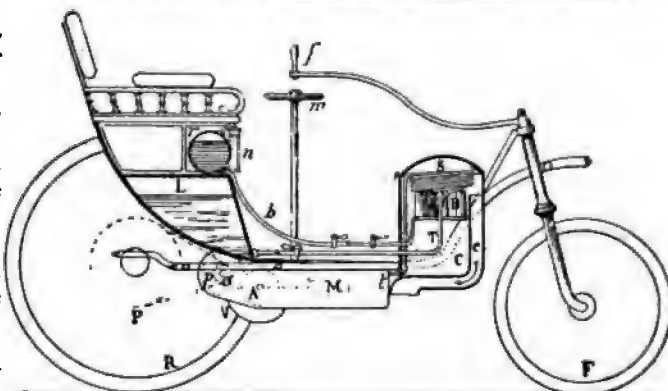
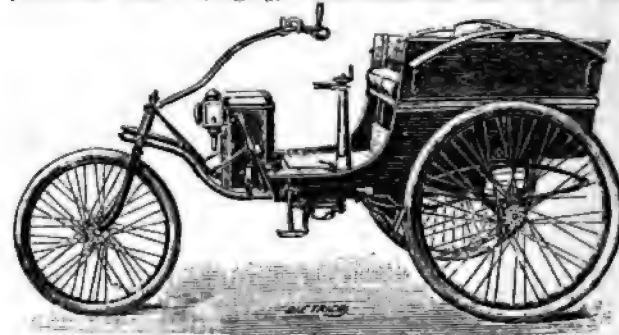
Fig. 3 shows a method of applying this reduction gear to the De Dion motor tricycles, necessitating the addition of a collar sliding on the large tube in the rear of the frame for the regulation transversely, a piece of dovetail slide in which by means of the screw the vertical regulation is obtained, the vertical piece carrying also the horizontal guide, which provides for horizontal regulation.

This reduction gear is claimed to have the following advantages:

1. Absence of shock and jar in changing speed, because the gears are always in mesh and in motion.
2. Ease of attachment and regulation.
3. Ease of lubrication and repair.
4. Provision for disconnecting the motor to let it cool or to give a freer use of the pedals in case of accident.

A New French Steam Carriage.

The illustrations, Fig. 1, 3 and 4, herewith show a new light steam motor carriage which has lately been introduced in France by the Societe Europeene d'Automobiles of Paris. As will be seen, the carriage, which is built in accordance with the designs and patents of MM. Tatin & Tanierre, is a light three-wheeled two-seated vehicle, its weight complete being only about 350 kilogrammes, or about 7½ cwt. The boiler, which is of the coiled tube flash type, is mounted on the fore splash-board (C, Fig. 3), while the engine M is mounted under the floor of the carriage. The feature of the boiler is that it is petroleum-fired. The oil is stored in a cylindrical tank v (Fig. 3) underneath the seat of the car-



FIGS. 3 AND 4.

riage. To this tank a small air pump n is attached, by means of which a certain degree of pressure is obtained in the former, which forces the liquid out of the tank and

causes it to pass along the feed pipe b to the tubular vaporizer B, arranged under the steam-vaporizing coil S. The vaporizer B terminates in four tubular nozzles, the ends of which communicate with four tubes leading into the exhaust C. The water tank L is also located underneath the seat, and has a capacity sufficient, it is stated, for a run of from 80 to 120 kilometres, on a level road. From the tank L (Fig. 3) the water is pumped to the boiler by hand at starting, but automatically afterwards through a connection between the motor and the pump, this being so arranged that should the speed of the motor become excessive the quantity of water allowed to pass to the boiler is automatically decreased. Both the petroleum and water feed pipes are provided with cocks, so that the supply of either may be shut off by the driver at any moment. The motor itself (M, Fig. 3) is of the horizontal double-acting type, without comprising any special feature.

As regards the transmission of the power from the crank-shaft to the rear road wheels, it will be seen from Fig. 4 that the shaft A carries at its ends two gear wheels Ee of different sizes, the vehicle being provided with two speeds. These wheels engage with corresponding gear wheels loosely mounted on an intermediary shaft a. Mounted on this shaft are two clutches (not shown in Fig. 4); the latter are connected to and controlled by the hand wheel m (Fig. 3), and are so fitted on the shaft that while revolving with it they are free to slide in and out of gear under the action of the hand wheel m. When one clutch is in gear the other is out, and vice versa, while with a point on the hand wheel m in a central position the motor is entirely put out of gear with the power-transmitting mechanism. From the shaft a the power is transmitted through one chain and the sprocket wheels Pp to the right hand rear road wheel, which is mounted loosely on the rear axle, the use of a differential gear being in this way obviated. In addition to being able to throw the engine out of gear with the power-transmitting mechanism, the driver is provided with a foot pedal (h, Fig. 4), which controls brakes acting on both the rear wheels. The engine is also so arranged that it can be instantly reversed, a backward motion being in this way provided. The front wheel is mounted between forks similarly as in a bicycle, the steering being effected by means of a long bar (f, Fig. 3) brought within easy reach of the driver. The wheels are of the suspension type, and are fitted with pneumatic tires. The Societe Europeene is also making a four-wheeled four-seated steam dog-cart, illustrated in Fig. 2, the boiler engine, and transmission being identical with that above described. The weight of this vehicle is stated to be 450 kilogrammes, or nearly 9 cwt. The makers claim that a speed of 25 kilometres per hour can easily be attained by their vehicles.—*Motor Car Journal*.

Motor Carriages for Hire.

On this page we illustrate a handsome vehicle, which, according to the *Motor Car Journal*, the Motor Coupé Co., of London, are now letting out on hire for private use in town or country for short or long periods. The cars are of the Daimler (Canstatt) type; the engine (four H. P. nominal) being placed at the rear of the carriage, and motion communicated to the rear road wheels by means of internal gearing wheel and pinion. They are certainly the most luxuriously fitted vehicle yet let on hire, and the company should have



MOTOR COUPÉ FOR HIRE.

no difficulty in readily placing every vehicle in active work. They are capable of traveling very long distances, being provided with ample water supply and also coolers.

It is a leading feature of the company's operations that those attending balls and theatres, etc., will be specially catered for. The tariff is a low one, and it is only fair to state that thoroughly competent drivers are employed. The charges quoted, for reference for others letting motor vehicles, we reproduce: First two hours, 10s., each hour after 4s. 6d.; dinner or theatre (single), 7s. 6d.; to and from theatre, 15s.; balls or receptions or opera, £1; one day not exceeding nine hours, £2 2s.; one week of six days (hirer to pay for all oil used), £7 7s.; Saturday afternoon to Monday morning, £4 4s.

We have received from Ulrico Hoepli, publisher of Milan, Italy, a manual of the automobile in Italian by G. Pedretti, a well-known mechanical engineer of the Peninsula. The work contains a large amount of engineering data and general information of interest to the student and user of the motor vehicle who is familiar with the Italian tongue.

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MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 628,967.—Electrically-Driven Vehicle. Henry Van Hovenbergh, of New York, N. Y., Assignor to Noah C. Rogers, of Greenwich, Connecticut.

Fig. 1 is a side elevation of the controlling apparatus, the outlines of a vehicle containing the same being shown in dot. Figs. 2 and 3 are views of detents of the controlling device; and Fig. 4 is a diagram of the electric circuits, showing their relation to the regulating devices.

Fig. 1.

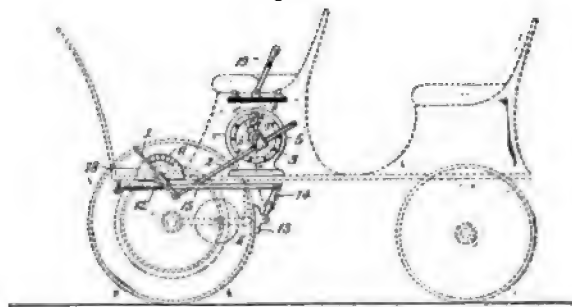


Fig. 2.

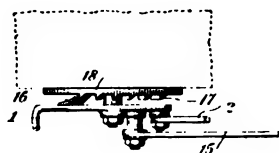
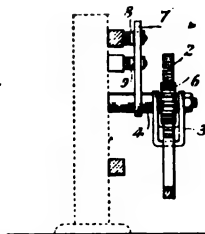
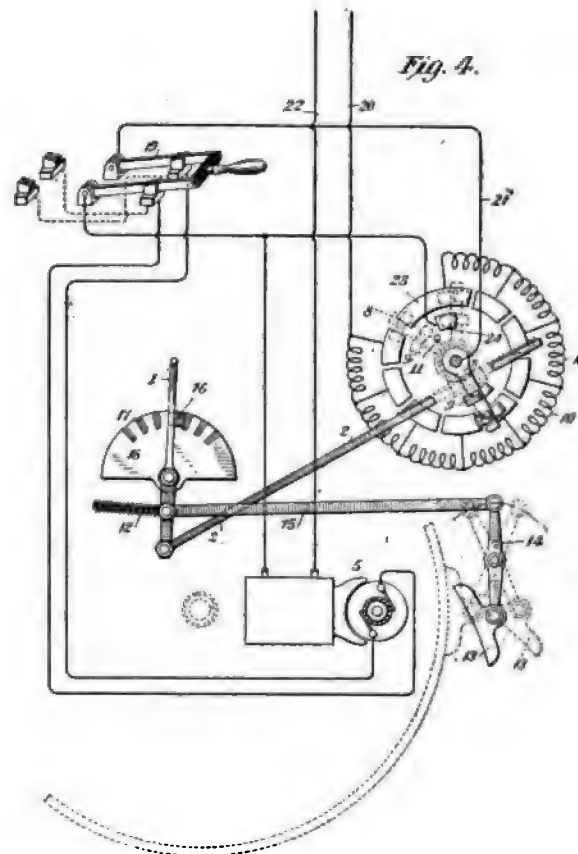


Fig. 3.



1 represents a foot-lever pivoted on the vehicle-frame and located on the side where the driver is most accustomed to sit—commonly the right side. It is pivotally connected with a rack-bar 2, supported by and sliding in a yoke 3, pivotally suspended from a sleeve 4 (see Fig. 3) on the armature-shaft of the propelling electric motor 5. Secured to the sleeve 4 on the outside is a gear-wheel 6, cooperating with the rack, and on the inside a brush-arm 7, carrying two trailers or brushes 8 9, the former adapted to engage a series of contact-blocks, between which are interposed resistance-coils 10. (See Fig. 4.) The contact-blocks are arranged in circular order, and the parts are so arranged that the brush 8 may be made to sweep the entire circle and the arm finally brought against a stop 2 when the friction-brake is set. The foot-lever is controlled by a spring 12, which normally holds it in a position in which the resistance is cut out, the armature short-circuited, and the friction-brake set. The brake-shoe 13 is mounted on a lever 14, journaled in a standard secured to the vehicle-frame, said lever being connected by a rigid link 15 with the foot-lever. The foot-lever carries a



spring-dog 16, (See Fig. 2,) adapted to engage any one of a series of detents 17, mounted on a circular frame 18, to arrest it at any desired position to graduate the strength of current as desired to suit the speed or grade. A reversing-switch 19 permits the armature-circuit of the motor to be reversed and therefore the direction of movement of the vehicle.

The operation of the organization will best be understood from the diagram Fig. 4. In the position shown the motor is in action at partial speed, part of the resistance 10 having been cut out. The field-magnet and armature are shown as series connected, but may be in shunt relation, as preferred. Current passes from the supply-circuit—a trolley-wire or other source—through a circuit-closer (not shown) by way of conductor 20 through such part of the resistance 10 as may be included by the position of the brush 8, through the latter to a brush bearing on a collar at the hub, thence by conductor 21 to the reversing-switch, thence to the armature and back to the other pole of the switch, and thence to the field-magnet coil and back to the return supply-wire by conductor 22. In stopping the vehicle the driver pushes with his foot on lever 1, thus gradually cutting in resistance to the motor-circuit and slowing the motor down until the brush 8 is brought to the final contact-block 23, when the brush 9 engages contact-block 24. Thus it will be seen that the movement of the foot-lever through a short arc shifts the brushes of the rheostat over almost a complete circle by reason of the multiplying-gear afforded by the rack and pinion which operate the rheostat. The motor then acts as a short-circuited generator having an independently-charged field-magnet, and a powerful magnetic brake is brought into action to check the speed of the armature and slow down

the vehicle, the field-magnet being excited by current flowing over conductor 20 through the resistance-coils of the rheostat to the contact-segment 23 thereof, thence by the brush-lever to contact 24 through the field-magnet and out by conductor 22, and the armature-current flowing from one pole of the switch over conductor 21 to the brush-lever, across the latter to contact 24, and back to the other pole of the switch. On further pressure of the foot-lever the friction-brake is set and the vehicle is brought to rest, where it is held until the foot-lever is released. In case it is desired to back the vehicle the reversing-switch is operated and the foot-lever is partially released. It will thus be seen that the entire control of the motive power as to speed or rest is by the driver's foot, permitting the driver to use both hands to operate the steering-gear. The latter may be of any approved kind. It has been deemed unnecessary to show it, as it forms no part of the invention. This organization permits the vehicle to be controlled by the simple and natural method used on horse-drawn vehicles and the one which is exclusively resorted to in sudden emergencies, and, moreover, requires a minimum amount of exertion upon the part of the driver, as it leaves his hands free to manipulate the steering-gear.

No. 629,079.—Electrically Propelled Vehicle. Rudolph M. Hunter, Philadelphia, Pa. Application filed March 4, 1899. This refers to the design of the body and the arrangement of the batteries in the vehicle.

Reissue No. 11,760.—Morton Vehicle. Andrew L. Riker. New York, N. Y. Original No. 620,968, dated March 14, 1899. Application for reissue filed June 3, 1899. This patent refers to the running gear, brake, steering gear, etc., and has already been described in our columns.

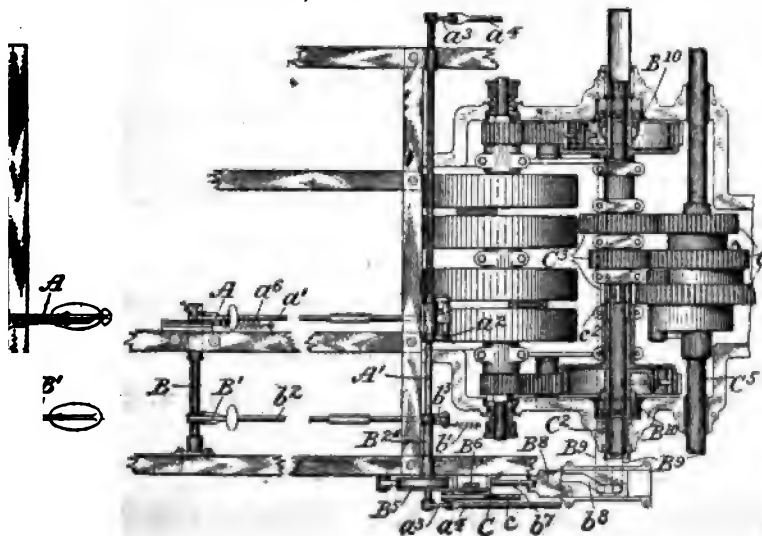
No. 627,962.—Roller Bearing.—William B. Allen, Hartford, Conn., Assignor to the Premier Manufacturing Company, same place. Filed Nov. 26, 1897. Serial No. 659,727. (No model.)

No. 628,469.—Gearing.—Thomas Humpage, Bristol, England. Filed Dec. 30, 1897. Serial No. 664,496. (No model.)

BRITISH PATENTS.

No. 6,915.—Improvements in Motor Road Vehicles. Pope Mfg. Co., Hartford, Conn.

Claim.—A motor vehicle having four independent operating levers or handles, one for each foot and hand of the driver.



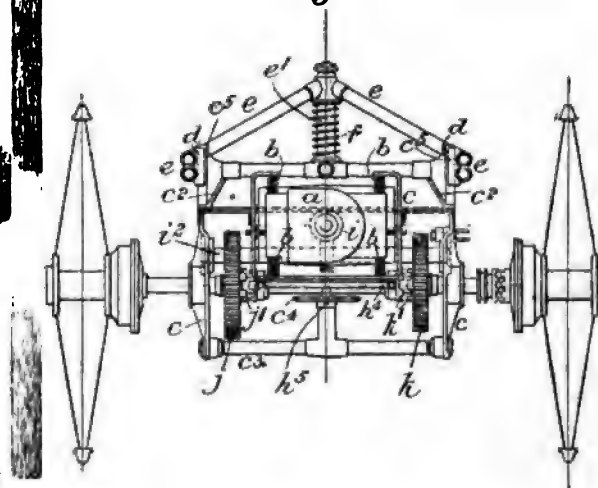
the several levers or handles being respectively connected by independent means to the steering mechanism, to the speed controlling mechanism, to the brake, and to the clutch device for controlling the connection between the motor and the driving wheels, reversing mechanism with its operating handle located adjacent to the speed controlling handle or lever, and a device for interlocking the reversing handle or lever and the speed controlling handle or lever whereby the former cannot be operated except when the latter is in its initial position.

No. 6,605.—Improvements in Motor Road Vehicles. Pope Mfg. Co., Hartford, Conn.

This invention relates to the propulsion of light motor vehicles which are dependent in parts upon the strength of the driver or operator and in part upon some other propulsive force, or, in other words, of vehicles in which the operation of the motor is to some extent effected or assisted or supplemented by the driver. Vehicles of this description are used for such purposes and under such conditions that their mechanism should be simple and light and should answer promptly and proportionately to the governing or controlling action of the driver or operator, and such action should be intuitive and natural. The object of this invention is to provide a motor vehicle in which the energy of the driver or operator in working a pump or other apparatus to supply varying quantities of explosive mixture to an explosion engine or motor shall be proportionately multiplied through the action of such motor to effect the propulsion of the vehicle, whereby the movement of the vehicle shall respond promptly to the will of the driver or operator. In the accompanying drawings, in which the invention is illustrated—

No. 278.—Improvements in Motor-Propelled Road Vehicles. William Peck, F. R. A. S., F. R. S. E., Edinburgh, Scotland.

Fig. 2.



The motor *a* is supported between springs *b* on a frame *c* capable of rotating in an upper frame *c'* provided with slides *c''* capable of sliding vertically in guides *d* carried by the forepart of the frame *e* upon which the body of the vehicle (which is not shown and which may be of any approved design) is mounted. The frame *e* is preferably built of tubes and junction pieces, after the manner in which a bicycle frame is made. The front part of this frame is made of pyramidal, or arched, form and carries a guide *e'* encircled

by a spring *f* which constitutes a yielding support for the vehicle-body. On a cross-bar *c*³ of the frame *c* is pivotally mounted a chain wheel *c*⁴ around which passes a chain *g* passing also around a chain wheel *h* on a vertical shaft *h*¹ passing through the tubular post *h*² and having a handle *h*³ at top, by which the speed can be altered by shifting clutches *j*¹ *k*¹ connected together by a rod *h*⁴ movable in relation to, and parallel with, the front wheel axle, to put into operative connection with the motor, either the slow speed wheels at *j* or the quick wheels at *k*; the rod *h*⁴ is provided with a pin or projection *h*⁵ which engages with a slot in the chain-wheel *c*⁴ so that when the said wheel is rotated the necessary movement will be imparted to the rod *h*⁴ and adjustable portions of the clutches *j*¹ *k*¹. The motor *a* drives the axle of the front wheels by means of a worm *i* Fig. 2, engaging with a worm wheel on a countershaft *i*² provided with toothed wheels gearing with the slow speed and quick speed wheels *j*, *k* on the axle. The handle and lever at *l* is for steering, by turning, by means of the rod *l*², the lower frame *c* in either direction in the frame *c*³.

The accumulators (or tanks as the case may be) are supported by a carrier *m* suspended by springs. The hind wheels have on their axes brake pulleys *n* with straps *n*¹ around them secured at one end to depending brackets *n*² and at the other end to levers on a rocking shaft *p* actuated by a foot lever *p*³.

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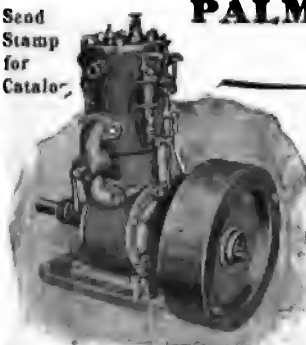
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NUMBER 19

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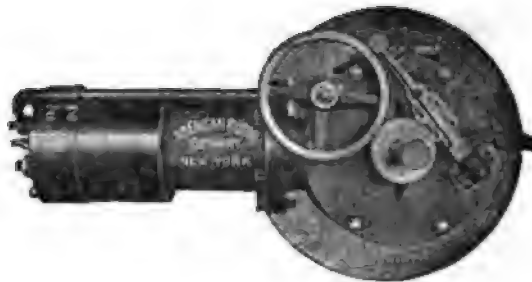
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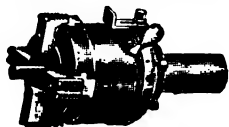
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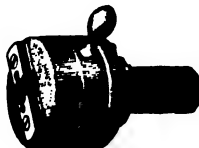
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DEVOTED TO MOTOR INTERESTS

VOL. IV.

NEW YORK, AUGUST 9, 1899.

No. 19.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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Western Roads.

Eastern people have a total misconception of the nature of the roads in the middle and far western sections of the United States. The impression seems to prevail that out on the plains and in the Rocky Mountains roads are of the worst border type, full of ruts, boulders and sharp stones, and requiring grades of 25 to 30 per cent. The transcontinental tourists who set out a month ago for the Pacific coast have been repeatedly warned to beware of the Rocky Mountain roads, which would surely be their undoing. The difficulties of the East were but molehills compared with the mountains of the West.

Anyone who is familiar with the roads of Nebraska, Kansas, Iowa, Colorado, Wyoming and Utah will confirm the statement that in these high plateaus the roads are among the finest in the world. They are natural roads, needing no making, and retaining their hard and smooth surface in nearly all kinds of weather. Speeds of 18 to 20 miles an hour could

safely be taken there almost without interruption for hundreds of miles. As for the chimerical grades which Eastern people imagine must necessarily exist in these mountainous regions, the wagon road leading up to the summit of Pike's Peak has only a 10 per cent. grade, and the cogwheel railroad by which tourists generally ascend the mountain rises at an incline of only 25 per cent. Some sharp stones and ledges are encountered in passing over the Rockies, but it would be very easy to find worse roads in the Eastern States than any which the transcontinental tourists will encounter in the West, should their carriage survive the ordeal of the early stages of the journey.

The Rocky Mountain plateau is an ideal place for all kinds of motor vehicles. Strong brakes and special shoes to protect the tires from the stones will be desirable, but the country is socially and topographically favorable for the motor vehicle.

The Demonstrating Arena.

The practical value of the demonstrating arena or track has been proved to the satisfaction of the English motor vehicle trade by the experience of the two exhibitions just held there. While the public are no doubt interested in seeing motor vehicles arrayed on view at exhibitions, where comparisons may easily be made, and a conception may be had of the *tout ensemble* of an industry, an intimate acquaintance with the machine can only be gained by taking a seat in it and enjoying the sensations of the new locomotion. Next to driving a motor carriage, riding in one is the best educator, and few will be content long with the rôle of passenger if they can operate a motor carriage of their own.

The demonstrating arena should always be an adjunct of a motor vehicle exhibition, and if the old traditional bicycle exhibition buildings do not afford facilities for the operation of vehicles, new sites should be sought where land for the purpose is available. The public want to see the vehicles in motion.

Speed Limit Increased.

In England the speed limit of 8 miles an hour for motor vehicles of two tons weight is becoming irksome, and a sentiment is spreading that will no doubt soon result in a petition to increase the speed at which such vehicles can lawfully be run to 10 or 12 miles an hour. This petition is quite certain to be favorably entertained by the authorities, and an increase to at least 10 miles an hour will soon be allowed, and this in turn may be safely exceeded when motor vehicles are in more general operation and the knowledge of their control is as common as the art of driving a horse is to-day.

However, in fixing the limit low at the start the authorities took a prudent course in the interest of the public safety and the new industry itself. The learner cannot expect to do what the expert finds easy as habit can make it.

Controlling Levers.

The remarks on steering which were made in a recent issue will bear supplementing. A mode of steering, which is applicable to one style of vehicle will not be applicable to another. On the French racing machines the usual steering lever has been discarded in favor of the wheel, inasmuch as the former was too sensitive for the highest speeds. For a gasoline pleasure vehicle, where the control of speed is of prime importance, two levers have been found best, and the same will doubtless be true of heavy work wagons of all kinds; but in an electric pleasure carriage like that of Mr. Sperry, recently described in our columns, with its automatic devices and easy control, both functions of control might be successfully combined in one lever. It does not follow, however, that this method of control could be generally imitated with success.

None But Teetotalers.

What has been said in these columns in regard to the superior character and abilities of motor vehicle drivers as compared with horse drivers finds confirmation in the report from England that a motor company there running a line of public vehicles includes among the conditions under which its drivers are hired a clause stipulating that they must be teetotalers. The employer of motor drivers at this incipient stage has every reason to be careful of the kind of men he selects to take charge of his vehicles. The eye of the public is on him, and the industry in which he has embarked has not yet felt the depressing effect of over-competition to reduce wages and lower the standard of labor in its ranks.

Careless Drivers of Horses.

The motor vehicle is rendering good public service in exposing the carelessness of drivers of horses. Contributors to

our "Lessons of the Road" columns have repeatedly shown that a large proportion of the accidents ascribed to the motor vehicle are due to the stupidity of drivers who habitually drive with loose reins, so that quick control of their horses is impossible or are themselves more frightened than their horses at the appearance of a horseless vehicle. The majority of the runaways in our streets are undoubtedly caused by this same lack of attention to their business on the part of those intrusted with the driving of horses, for if a frightened horse is properly checked and pacified before he is terror-stricken and unmanageable a runaway is averted. But when the reins are hanging limp over the dashboard and the driver is dreaming or seeing the sights the horse soon gets the start and escapes all control.

The driver of a horse (the horse's owner is responsible for the driver) is assuming a moral and legal responsibility when he brings an animal upon the highway, where all have equal rights with himself, and the time has arrived when this responsibility must be recognized and drivers held accountable for the animals they guide. The drivers of motor vehicles will for some time at least be under strict surveillance, and justice demands that drivers of horses be treated in the same manner. "Accident," "uncontrollable beast," etc., will not prove as satisfactory excuses hereafter as they have in the past. Uncontrollable beasts should not be allowed on the highways, and for accidents that are ascribable to carelessness somebody must be made to pay.

A little later, when the inferiority of the horse as compared with the motor is generally admitted, the horse will be quietly and quickly dropped until the responsibility as between horse and motor will be clearly fixed where it has always belonged—on the owner of an untamable brute which man has cowed and beaten into partial subjection, but which in revenge bursts his bonds occasionally, carrying ruin and death through our streets.

The Mortality Among the Chauffeurs.

Recent advices from Paris furnish additional proof of the timeliness of the warnings against excessive speeds which have been from time to time sounded in this journal. The mortality among the chauffeurs is alarmingly high, and even the French sporting papers begin to see that a pastime which breaks the necks of some of its devotees every day or two is one which none but undertakers will care to encourage.

In utilitarian ethics a man has a right to risk his own life and to sacrifice it in whatever way he chooses; but when in endangering his own life he exposes the community to like danger with himself, he violates the moral law and becomes an enemy of society. Consequently, it is necessary, in the common interest, to restrain the enthusiasm of those whose sporting proclivities lead them to misuse the common roads. Speed laws are enacted to preserve the safety of the highways, and

the sporting fraternity are compelled to build private tracks for themselves, where they can break their records and break their necks without interfering with the rights of others. This will doubtless be done in France soon, and will be the outcome of the speed craze in this country, too.

A Rocky Mountain Climber.

Denver, Colo., mechanics are much elated over the success which recently attended the first trial run of a motor wagon built by Robert Temple, a well-known Denver machinist, of 1,513 Wazee St.

The vehicle, which resembles a mountain wagon in general design, was built to order for a doctor of Cripple Creek, who is using it for advertising and professional purposes.

The full seating capacity of the wagon is 14, although on this initial trip only one seat besides the driver's was carried.

The wagon weighs about 2,300 lbs., and is propelled by a gasoline motor weighing 400 lbs., and developing 8 to 10 h.p. Two cylinders, $5\frac{1}{8} \times 6$, and made of steel and cast iron, are placed in line, the connecting rods being offset at 180° to minimize vibration.

Hot tube ignition instead of the electric is employed, as Mr. Temple believes it the more reliable of the two.

About 15 gals. of water are carried to supply the jacket, and automatic sight feed lubrication keeps all the bearings well oiled. The bearings, which are of bronze, are of large surface.

There are two forward speeds, the maximum being 15 miles an hour, and a reverse, obtained by means of belts to a countershaft fitted with a compensating gear, and thence by chain and large sprockets to the rear wheels. Intermediate speeds are obtained by throttling the mixture from the seat. No carbureter is required, the gasoline being vaporized as used.

The steering lever, which is at the right of the driver, works backward and forward, and for the regulation of speed two levers are provided at the left, one for the high speed and the other for hill climbing. When either one of these speed levers is pulled back it sets the brake.

An electric alarm bell is controlled by a button in the floor convenient to the foot.

The body of the wagon rests upon a channel steel frame, to which is bolted the motor end transmission mechanism.

The trial trip of this wagon was probably the most difficult ever undertaken by an untried motor wagon. It extended from Denver through Colorado Springs and Manitou to Cripple Creek, the famous gold fields, a distance by road of nearly 175 miles, fully two-thirds of which is steep hills, varied by stretches of the loose alkali sand for which the Colorado plateau is famous, yet not once did the motor fail. The brakes proved insufficient, and the hill climbing belt will be replaced by a gear to secure a more positive transmission. For many miles grades of 15 per cent. or more were climbed. A brace rod of iron was swiveled to the rear axle and allowed to drag upon the ground as an additional precaution to guard against accident in case of the failure of the brakes.

Mr. Temple is so well pleased with his first performance that he will design and build a special type of motor wagon adapted for use in the Rocky Mountain region.

The 2-in. solid tires which were used were badly cut by the sharp stones and ledges of rock encountered on the roads.

The American Electric Vehicles.

The American Electric Vehicle Co., of Chicago, Ill., are now manufacturing eight standard types of vehicles—a run-about buggy, a four-passenger brake, dos-a-dos trap, brougham, stanhope, delivery wagon and an open runabout. Their system, which is now well developed, exhibits a number of special features that are worthy of mention.

They have adopted the single-motor equipment as most economical for this work.

The batteries of their own manufacture are 25 per cent. lighter than other batteries employed for the propulsion of vehicles. The grid is rolled and has a much greater number of interstices than is possible in a cast grid. Both plates have the same number of interstices, but in the positive they are somewhat heavier. The active material is mixed up with oxide and finely divided metallic lead, and is pressed into the grid, making the latter homogeneous and compact. After going through a forming process the plates are placed in jars of special design, giving greater strength at the corners and permitting ventilation so that in damp weather the wagon will dry out quickly. Separators give extra support to the plates and prevent buckling, and also keep them at equal distances apart, so that they discharge equally notwithstanding the vibration of the vehicle.

The new four-passenger brake which was on the floor when the editor of The Horseless Age visited the factory weighs 2,850 lbs., and is of solid construction throughout. The body is supported by four full elliptical springs, fastened by heavy angle irons firmly bolted and extending across the entire body.

The rear axle is a solid bar $2\frac{1}{8}$ in. square, and from it the motor is hung on sleeves, provided with turn sections which fit the clamps holding the motor, and also having two extension arms, or distance rods, supporting the bearings, which are of the ball and socket type. These rods maintain an equal distance between the axle and the gear wheel, so that through all the displacements of the motor, due to the inequalities of the road, the gears will always work on the pitch line. These distance rods are adjustable for wear or other reasons.

From the motor casing a reach bar extends to the forward axle and is swiveled thereto. Extending down from this bar is an angle arm pivoted to the motor casing, the end of which angle arm has an eye, through which passes a pivoted bolt fastening it to the motor casing. On each side of this bolt is a rubber cushion kept at equal tension by two jam nuts. In this way the strains are distributed over the frame, and the motor and transmission work freely and in line under all conditions.

The forward axle is fastened to the springs by heavy clips, and terminates at each end in strong sockets to receive the steering pivots. These sockets are swedged up from the solid bar without welding. The sockets and the steering L are made of unusual length to provide sufficient bearing surface. From the top of the steering L extends an arm to the rods connected with the steering lever.

The motor is of 4 h.p., capable of an overload of 50 per cent. The battery consists of 44 cells, each weighing 21 lbs. complete.

All the controlling apparatus is directly under the seat, where it is readily accessible, the automatic charging switch also being placed there. The controlling mechanism is operated from a gear segment mounted on a small shaft connected with the



ELECTRIC BRAKE OF THE AMERICAN ELECTRIC VEHICLE CO., CHICAGO, ILL.

controlling lever. A spring pawl and ratchet insures perfect contact with the controller at every step. A cam device is provided, so that when a locking key is withdrawn the circuit is broken in four places and the lever cannot be moved. The vehicle is then safe from meddling hands. When the lever is at the starting points, all the connections for charging are properly made.

The wheels have wooden spokes and solid hubs of cast steel. Both solid and pneumatic tires are furnished, the preference being given to the Flat Tread Pneumatic.

This company has five stories at 56 and 58 W. Van Buren St. entirely devoted to the manufacture of electric vehicles.

Transcontinental Tourists.

The transcontinental tourists who were detained at Syracuse, N. Y., by the breaking of one of the cylinders of the engine, and were compelled to send to the factory at Stamford, Conn., for another, did not get away on Wednesday, as anticipated, owing to the improper boring of the new cylinder. They resumed their journey toward San Francisco on Saturday, however, hoping to make up for lost time.

Haynes-Apperson Cross Country Run.

Elwood Haynes and Edgar Apperson, who left Kokomo, Ind., last Monday in one of their carriages, bound for Brooklyn, N. Y., where the vehicle is to be delivered to its purchaser, Dr. A. A. Webber, reached Buffalo, N. Y., on Thursday, via Cleveland. There they were delayed for a time by a punctured tire, but proceeded on their way Friday. The object of the journey was to demonstrate the practical running qualities of the carriage and not to make high speed. An average of 14 miles an hour has been maintained, however, from the start.

A Motor Pit.

George L. Weiss, of Cleveland, O., a well-known enthusiast in the cause of the motor vehicle, is having his barn enlarged and remodeled with special reference to the storage and care of motor carriages. One of the improvements which he will introduce will be a motor pit, from which the motor and mechanism of a motor carriage can be easily inspected and repaired.

COMMUNICATIONS.

Favors Better Mufflers.

San Diego, Cal., July 17, 1899.

Editor Horseless Age:

In view of the fact that one of the greatest objections to the gasoline motor carriage is scaring horses, I am somewhat surprised that manufacturers do not use more efficient mufflers.

I know of one carriage in particular which has just come from the factory, and although it is provided with an improved muffler, it can be heard several blocks. There is a gasoline launch here that can be heard 2 miles. The engine is a new one and built by one of the largest manufacturers. This is also provided with a muffler, so called.

I cannot understand why manufacturers continue to use obsolete and inefficient devices, which sometimes seem to increase the noise, when there are perfect silencers of the exhaust on the market.

A muffler to be of any value should completely stop all noise of exhaust and at the same time give no back pressure. This has already been accomplished. Yours respectfully,

W. E. STEFFEY.

Vague and One-sided Ideas of Purchasers.

Peoria, Ill., July 24.

Editor Horseless Age:

There is a large opportunity to study the one-sided mental characteristics of both horses and drivers in connection with the motor vehicles. Many amusing instances occur daily, and some very interesting reading could be had if they were collected and classified.

It is commonly supposed that the noise of the new vehicle is what scares horses, but it is very easily proven that such is not the case. Both horses and drivers recognize that it is a new thing, and their astonishment sometimes amounts to fright. For example, when coasting hills it is our practice to stop the motor and control the vehicle by clutches or brake, or both, so that there is no puffing nor noise of gearing, and the wagon is practically as quiet as a bicycle. It is also our practice to go slow, keeping the vehicle in perfect control, and with the ability to stop it at any point on the hill; yet under these circumstances horses get as badly frightened sometimes as when the motor is running, proving conclusively that it is not the noise that scares the horse. Neither is it the shape of the vehicle, for some of our vehicles can not be told at a glance from horse vehicles.

It is the simple fact that a vehicle without a horse is a strange and, to the horse, an unaccountable thing.

Many instances could be cited to show that the same feeling exists among people, particularly children, and while most people have no fears, some instances of adults getting badly scared could be cited.

The most common feeling, however, is complete astonishment and an utter forgetfulness of everything excepting the sight in front of them. This accounts for a driver's sitting still in his vehicle with loose lines while the horse does a can-can, to the danger of all concerned. Many times we have vainly shouted to the driver to look out for his horse, while he, in open-mouthed wonder, failed to see anything but our vehicle.

It is a common remark also that motor vehicles are noisy, although they immediately ask us why we do not put on a bell, lest we run over somebody, and further ask us how we came down the street without their hearing us, both of which remarks show very plainly the absence of noise and also show that peculiar condition of a man's mind, which, because it is a motor vehicle, presupposes noise.

It is pleasant to note, however, that these new and adverse conditions are now changing. The public are rapidly waking up to the advantages of the mechanical motor over the horse, and encouragement rather than opposition is becoming the order of the day.

Another phase of the mind is shown by people's views as to what the motor vehicle ought to be, having nothing except their own imaginations to guide them. They are more or less disappointed with every vehicle shown. It is either too heavy or too light, too high or too low, too long or too short, too fast or too slow, or some other reason is assigned for their not liking it, simply and solely because they in their inexperience have set up an imaginary and impossible model.

They forget that the horse has many objectionable features and are surprised to find that the motor vehicle has any, although they are aware that nothing in this world is perfect.

In a recent letter, a doctor who is a cycle rider and a man of sound sense objects because the vehicle offered him ap-

peared so little for the money, when as a matter of fact the light weight and neat appearance are strong evidences in the vehicle's favor. The same man rides a bicycle weighing less than 25 lbs. and without brakes or mud guard because of its general good features, when he could have had a great deal more for his money by buying one made 10 years ago, weighing 50 lbs., having 30-in. or 32-in. wheels, mud guards, brake, coasters, etc.—double the quantity for less money.

This looks like inconsistency, but the man is honest and trying to be consistent. The fault is in the mental condition in which his inexperience finds him, and it is because of such peculiar ideas that all or part of the buyers need more education along this line.

CHAS. E. DURYEA.

About the Axes of the Steering Wheels.

Editor Horseless Age:

I wish to both commend and criticise some features lately discussed by Elmer A. Sperry in his paper on "Electric Automobiles."

Mr. Sperry's oblique axes for the steering wheels of automobiles is the practical demonstration of a design that has laid upon my desk for some months, the outcome of a theoretical study of the question. I am glad to know that the practice so nearly coincides with the theory, even though another forestalled me in its actual application to a carriage.

There are, however, a number of things in connection with the theory as I work it out that do not seem to have been considered by Mr. Sperry—at least, he makes no mention of them, which is unfortunate, as they are all that prevent the oblique axes, if at all, from becoming the chosen mode of construction, for it certainly is of great importance to determine a better method of steering, if possible. Just as the two-passenger horse carriage is the most widely used now, so will it be with the demand for motor carriages, and to allow of this, ease and simplicity of steering and low first cost are indispensable. To accomplish this no power other than that in the driver's arm must be called upon.

No difficulty arises with the ordinary swivel axes on pavements and smooth roadways, but as the type of carriage we speak of is to be the carriage of the general populace it must take the roads as it finds them, and for a long time to come it will not find them ideal. The roads as they are, then, must be traversed with a minimum of effort and discomfort to the driver, especially as the survival of the fittest will doubtless continue to be evidenced in the method whereby steering, starting, stopping and perhaps breaking are accomplished by diverse movements of the steering handle. The device which best meets the requirements of such control is very welcome, I venture.

Now as to Mr. Sperry's oblique axes. That his device tends to automatically place and hold the steering wheels with their planes straight ahead is quite evident. It is, also, admirably adapted to sustain the shock of a wheel meeting obstructions without transmitting stress to the steering handle, while, doubtless, the added ease with which the steering handle may be moved at the moment of meeting an obstruction more than compensates for the resistance caused by the self-centering tendency due to the obliquity of the axes. But a point has now been reached where I am not prepared to fully agree with Mr. Sperry that his method has no disadvantages. Indeed I must take direct issue with him on the effect produced upon

tire and wheel due to the inclination of wheel planes to the roadway at the point of inertia resistance between straight-ahead and the given angle of turn. It accomplishes this in an ideal manner with one wheel, but more than offsets it by the disadvantageous movement of the other wheel. While the inner wheel meets the stress of turning along its plane, similar to the wheels of a bicycle, the outer one inclines in an opposite direction and receives the strain transversely where it is least calculated to bear it, causing both a pulling and a scraping of the tire extremely hard upon its fastening.

Another decided disadvantage is that in an attempt to draw out of ruts or deep cut wheel tracks the wheels are pinched against the sides of the track to the imminent danger of their collapse.

In closing let me suggest that could both steering wheels turn on oblique axes and remain parallel to each other an ideal method of steering light vehicles would result. But I confess I have no suggestions to offer that will make this possible without marring the good points already found in Mr. Sperry's method. Perhaps some one else can. Respectfully,

EDWD. A. HUENE.

Machinery and Tools.

By Robert I. Clegg.

2—CUTTING UP STOCK.

Cutting-off tools of various kinds form an important branch of shop equipment, inasmuch that the economical cutting of the varied materials into easily handled lengths for motor vehicle construction may here receive more than the attention that is usually accorded to that detail, and which is certainly no more than is due the subject. The writer will not now deal with such cutting-off tools as are in use in screw-machine work, for this class of shop mechanism will be dealt with at some length separately.

Metals of many shapes and degrees of hardness enter into the making of motor vehicles, from hard steel pins and rods to babbitt-metal linings.

Cutting up hard steel rods can be done on the anvil with a good, stiff chisel, somewhat heavier than the longer chipping chisel, which should have a little spring and need not be hard; put in two well-defined nicks in opposite sides, and then place the cut over hardy hole, i. e., the square hole in anvil; hold the rod down solid and strike a sharp blow on the rod over the hole. If the piece to be broken off is short, there is a possibility that a too heavy blow may cause the broken piece to fly upward and strike the workman; a safe plan is to get an assistant to hold a hammer above the end to be broken away. A chisel, by the way, is not nearly so simple a tool to make as it looks, and in view of its usefulness a few suggestions as to the forging, etc., may be offered. A piece of $\frac{7}{8}$ -in. octagon steel about 8 in. long should have the point drawn down until chisel is not over 10 in. altogether; work the steel at a low heat, and do not continue hammering after heat cools beyond a dark red; have as few heats as possible, and reheat slowly, turning chisel around in fire to obtain uniform effect. Do not heat higher than the heat requisite to harden that particular brand—the temper mark will be found on side of tool-steel bar—quench in brine or clear water, rub with emery stick and draw down to a temper between a purple and a blue. For the more

refractory metal work a harder condition will give satisfaction.

In cutting off tool steel some smiths first nick the bar on two sides, as in the method already described; but, instead of holding bar over hardy hole to break, the bar is passed through a hole in the "sow," the one end is raised, the cut in bar resting against further corner of hole in "sow," and a sharp rap finishes the job. Both plans are shown in Figs. 1 and 2; the writer prefers the former.

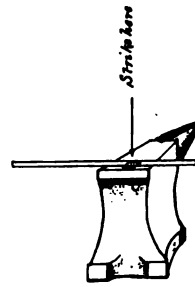


Fig. 1

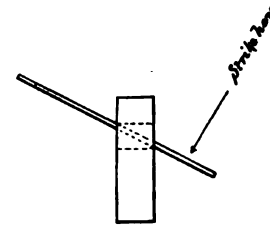


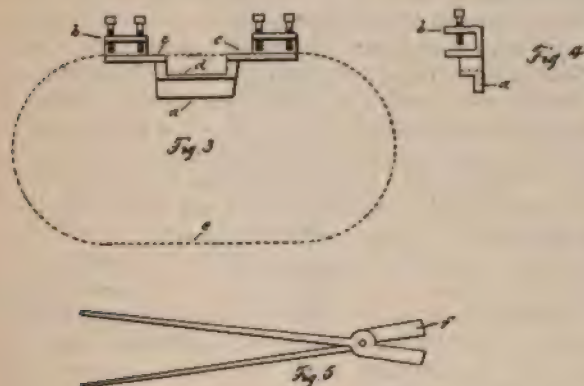
Fig. 2

Angle steel is cut at the mills, and in bridge work, with a triangular-bladed shear, and for the purpose named, little fault can be found with such a method; for the few operations necessary on a vehicle frame built of angle steel the manufacturer might not unnaturally demur to the cost of a machine that would be inoperative the greater part of the time, even in a large factory; some criticism also could reasonably be made as to the sheared surfaces not making such clean, close joints as would be required for work of this class. The writer would therefore suggest the power saw, of which there are several sorts and sizes in the market. The power saw, which has a reciprocating movement similar to a hand hack-saw and uses saw blades of the same type, can be put to work cutting up shafts and the longer studs and spindles when not engaged in the cutting of frame stock. Care should be taken to get saw blades suitable for the work in hand, a coarse tooth for shafting and other shapes of sufficient cross-sectional area to keep several teeth in contact at the same instant; where, however, the cut is through metal, as light angle steel or tubing, then a saw blade of over 20 teeth to the inch should be selected, for the reason already given. It is exactly a parallel case to that of a file, which may be dull enough not to bite a flat surface, but yet will readily cut a narrow one; and, as the saw teeth are brittle, considered singly, the strain should be divided over several teeth to obtain the best results from the machine.

The writer has seen in England a slitting saw mounted on an arbor capable not only of rotation about its axis, but also a translatory movement across a table or platen; this is decidedly preferable to cutting up shafting, etc., on the milling machine where the overhanging weight is often very objectionable; nevertheless, neither seems so good as the power hack-saw, used with discretion. Frequently the machine is run too fast, and is too heavily weighted; the speed should be about 60 strokes to the minute and the weight moved out just far enough to have the teeth take hold nicely.

The writer has a shop in mind which handles large quantities of machinery, and annealed tool steel, with the exception of the larger rounds, say, over $1\frac{3}{4}$ in. in diameter, all

are cut with a band saw. The shop makes a specialty of die, cutter and punch work, and the saw does a clean, square cut, needing no after trimming, and, of course, a minimum of waste. Most shop managers do not take kindly to the band saw, probably for fear that the blade will prove in practice difficult to keep in good repair and that the judgment which accompanies satisfactory results with this class of machine may not be too much in evidence with the grade of help who will be assigned to this labor. With the latter objection expert superintendence at the outset is the best safeguard, and to aid this somewhat a hint or two in reference to band-saw repairs is given here.



The cast-iron frame, shown in Figs. 2 and 3, is a simple pattern to make out of $\frac{3}{8}$ -in. stock and is drilled and tapped through "b" for $\frac{3}{8}$ or 7-16 set-screws; the frame is held in a vise by the projection "a." The broken ends of the band saw are brought under "b b" to the edge of the gap in frame at "d" and the set-screws put down to pinch hard enough so that the band saw may be scarfed back about $\frac{1}{4}$ in. at each end; this is done with a file at "c c." One end of saw is twisted half way around before setting down screws in order that when broken ends of saw are placed in position for brazing, subsequently, the two filed surfaces will come together face to face. The set-screws and the flat surface at "c c" allow a nice, even job to be done with ease; the joint is then treated with a coating of borax, ground with water to the consistency of cream; this grinding is best done with a pestle and mortar; loosen the set-screws and bring the two ends together, taking out the twist already mentioned, and have them overlap, as shown in Fig. 3 where the dotted line "e" illustrates the position of band saw ready for brazing, and the screws will retain it in place. If spelter be preferred, or already to hand, care should be observed to have it of such a degree of fusibility that it will melt thoroughly, leaving no lumps in joint. The writer prefers silver solder, which can be rolled very thin, melts evenly and flows well where needed. To keep the scarfed ends together and braze simultaneously requires the special tongs sketched in Fig. 5. the jaws at "f" are made heavy to retain the heat, say $1\frac{1}{4}$ in. square by 3 in. long; the jaws are heated in forge to red heat and then used to grip the joint of band saw at the gap "d" in Fig. 3, until the solder, which has been previously placed in position at the joint, shall first melt, then cool and set fast as the heat dissipates from jaws. The set-screws are loosened and joint placed upon one of the surfaces at "c," when any excess of solder or borax may be removed. A word of caution in reference, particularly, to brazing: The

filed surfaces should not be touched with the band, and all grease or oil, if accidentally or otherwise brought in contact with the surfaces, should be thoroughly removed by boiling out in a strong solution of soda. Knowing the tendency, from habit, of passing the hand over a filed surface, the attention of the machinist who has had little brazing to do is drawn to the positive cleanliness required for this operation, not only in the filing, but the flux and solder. The teeth of saw should be set in line, of course, before brazing. It was the intention to incorporate in this article a description of a special cutting-off device applied to the lathe; as the arrangement, however, can be made useful in turning down shafts, as armature, counter and rock shafts, it is carried over for treatment later.

J. B. West's Steam Motor.

The result of the experiments conducted by J. B. West, Rochester, N. Y., has been awaited with much interest by the motor vehicle fraternity. Mr. West has tested various motive powers during the past four years, but finally settled upon steam as the most suitable to his purpose. The motor here shown weighs 60 lbs., and develops 5 h.p. With the boiler and all its fixtures the weight of the propelling part is 250 lbs. Aluminum is used wherever possible in the motor.



J. B. WEST'S STEAM VEHICLE MOTOR

The generator is made of the best cold drawn steel tubing, the tubes being joined by a new thread of Mr. West's invention, called the "Parallelo-taper," with which, it is said, tubes of No. 20 thickness may be joined in sections that will stand a test of 2,200 lbs. to the square inch without leakage.

Means for regulating the fire and the water are employed, and gasoline, kerosene, coal or wood may be employed for fuel.

Like Ball Bearings for Motor Vehicles.

By H. B. Adams.

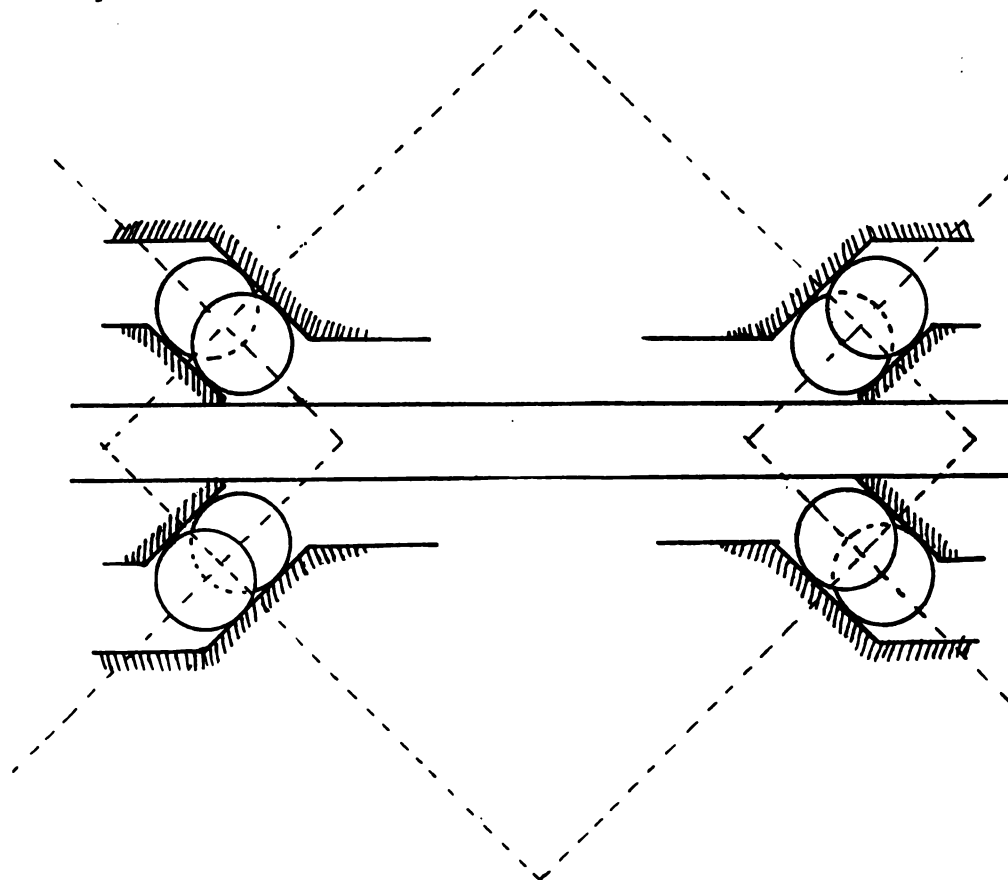
In the construction of motor vehicle axles, at this stage, a great deal depends upon the good judgment and experience of the builder, because there is no standard to guide him in the selection of the sizes, etc. In the ordinary carriage trade there has arisen a class of standards in use all over the country, and any carriage builder knows what size axle to use for a given weight. When he selects his size he knows the length, he knows the proper taper to absorb vibrating strains—in fact, knows exactly what he wants. But in a young industry, practically untried, new conditions confront us, because of the different speeds, the different weights, the different kinds of strain in steering and driving, and the liability of coasting down hill without control, and it will take several years of experience to build up a complete set of reliable standards. In the meantime, axles and bearings should be made of sufficient size to place the factor of safety beyond any possibility of accidents, which would be likely to injure the industry at the outset.

In the construction of anti-friction bearings it is easier to tell what not to do than what to do and how to do it. We will endeavor to show some things not to do; also show what the Adams Co., of Philadelphia, do and how and why they do it.

When we first begin to construct bearings we naturally consider the weight, or what we might call the straight up and down strain, the one hardest to overcome; therefore, we see

long rollers parallel to the axle to take care of that strain in reducing friction, and at each end of the axle one row of balls to take up the end strain. But as the inventor gets further along the rollers gradually shorten, and the balls to take up the end strain are gradually enlarged until, finally, we see cones at either end of the hub with a conical-shaped roller, or the roller discarded altogether, and two or three rows of cones to take up the end thrusts and the weight. At last the inventor finds the straight up and down strain the easiest to take care of, because he has discovered that the strain in a vehicle hub consists of alternating end thrusts, the straight up and down strain seldom exceeding to any considerable amount the actual weight carried. But in a vehicle going at the rate of 20 miles an hour, swinging around corners or dodging other vehicles, going in and out of ruts at high speed, the end thrusts exceed the weight many times. Therefore, it is absolutely necessary to consider the terrible end strains first and give the weight strain secondary consideration. This is the reason why, for heavy work and heavy vehicles, ball bearings have not heretofore been successfully applied. Not more than one row of balls could be maintained on a cone (and always bear) at a different angle from the center line of the axle.

Steel, like everything else, naturally has a limited life. It will stand a certain number of concussions, a certain number of deflections up to its elastic limit, and then it crystallizes and crumbles. The only way to make ball bearings successful is to place them in a position where they have as perfect a roll as a car wheel in its track, without any dragging, sliding, slipping or gyroscopic motion, and place as many under the



strain and cover as much wearing surface as is necessary for the maintenance of the life of the balls and the steel bearing surfaces. The Lake construction seems to solve this problem by parallel surfaces for cups and cones at an angle of 45 degrees from the center line of the axle, so that the strains always come on the square and insure perfect rolling. To maintain the balls on parallel surfaces there is a spacing ring or idler provided with oblong holes spacing the balls apart,



EACH BALL HAS A SEPARATE TRACK.

keeping them from rubbing each other at their peripheries and at the same time setting the track of each one in a separate line, so that as many rows of balls can be used at each end of the hub as is necessary. By this construction no weight can by any possibility be placed on the separators, and the oblong holes only permit the separators to touch the balls at their axial points or least points of revolution.



SEPARATOR FOR SINGLE ROW OF BALLS.

If it were not for the rusting of these bearings the Adams Co. would recommend that they be run without any oiling whatever, as they need no lubricating to overcome friction. They have been used on bicycles and have become quite popular because of their coasting and easy running qualities. They have also been thoroughly tested on carriages and heavy work; on motor carriages the company guarantees the carriage to run 25 per cent. easier than when equipped with any other bearing on the market. They make up and equip any style of hub desired, and also have several simple and valuable improvements in design, adjustments and general construction.

A Terminal Power Storage System for Motor Vehicles.

By P. M. Heldt.

Heat is a form of energy, and as such it is used on vehicles employing steam or explosive engines for their propulsion. The energy stored in these vehicles is not, however, in the form of thermal energy, but consists of the chemical potential energy of the fuel. By the process of combustion this chemical energy is transformed into thermal energy and the latter, by means of the engines, is again transformed, this time into mechanical energy, in which form it is applied to the driving mechanism.

Instead of storing the energy in the form of chemical energy it may be stored in the form it is used—thermal energy—and we have then what is called a thermal power storage system. Experiments have been made in England for a number of years with this power storage system, in connection with electric central stations, and MM. Hutin and Leblanc, two French scientists whose names are well known in connection with a number of very ingenious and practical electrical inventions, have lately brought out and patented in France a motor vehicle using this system of storing energy.

In England some practical results have been reached, and although the experiments were made with stationary plants of a much larger capacity than could be carried on a vehicle, they are of interest as showing the practicability and advantages of thermal power storage under certain conditions at least.

One of the first installations of this kind was that of the Gordon Hotel, of Margate, England. At this place a number of vertical cylindrical tanks of sheet steel with spherical heads were erected, into which the feed water is led. At times, when the consumption of steam by the engines is small, the steam is let into these reservoirs and heats up the feed water. The temperature of the feed water can thus be brought up to the temperature of steam at the boiler pressure, which increases the capacity of the boilers during the hours of greatest steam consumption from 20 to 25 per cent.

At first thought it would appear as though a large amount of heat would be lost from the storing tanks by radiation. It was found, however, that with well-covered piping, and the dimensions of the tanks here used—7 ft. diameter, 23 ft. length—the loss of heat is practically negligible. Prof. Unwin, who made some efficiency tests of this plant, found that the saving of fuel was considerably greater than would have been expected from theoretical considerations.

Another system, known as that of Druitt Halpin, has been in use in the municipal refuse destructor plant of Shoreditch Vestry in London. Here the energy is stored in the form of high pressure steam (225 lbs.). Before the steam is led into the engine cylinders the pressure is reduced to 125 lbs. per square inch. The amount of water that can thus be taken, in the form of steam, from the storage reservoir is equal to 5½ per cent. of the total water contained in the reservoir. For a certain amount of available energy the storage reservoirs must therefore be very large—very much larger than with the hot feed water system described above.

Returning now to the system of hot water storage for motor vehicles, the manner in which the heat energy of the water is transformed into mechanical energy is illustrated in

Fig. 1. C is a cylinder and P a piston movable in the cylinder. The space behind the piston is filled with superheated water.

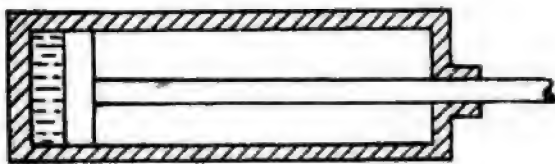


FIG 1.

To fix ideas, and to get some figures as to the amount of energy stored up in a certain quantity of water at a given temperature, we make the following assumptions: The quantity of water in the cylinder is 1 lb.; its initial temperature is t . The piston moves in the cylinder without friction, and the length of the cylinder is such that when the piston reaches the limit of its out-stroke the pressure in the cylinder is equal to atmospheric pressure.

At the beginning of the stroke the pressure per square inch on the piston is p_1 , the pressure of saturated steam at temperature t . This pressure will cause the piston to move forward. The space swept through by the piston is filled with steam, which draws the latent heat of its formation from the remaining water. The temperature of the water naturally falls, and with it the pressure of the steam. The relation between the position of the piston and the steam pressure is shown by the curve in Fig. 2. At the beginning of the stroke the pressure is equal to p_1 , and at the end equal to the atmospheric pressure, p_a . The shaded area represents the work done by the piston during the stroke.

The following table gives the number of foot-pounds of energy represented by the heat contained in a pound of water, as a function of the initial pressure. The table also gives the initial temperature of the water at the various pressures, and the final volume of the mixture of steam and water equal to a weight of 1 lb.:

Initial Pressure in Atmospheres.	Initial Temperature of Water.	Available Energy of Pound of Water.	Final Volume.
5 Atm.	306° Fahr.	4620 ft.-lbs.	2.48 cu. ft.
10 "	358 "	13150 "	3.68 "
15 "	392 "	19970 "	4.41 "
20 "	419 "	23350 "	5.02 "
25 "	439 "	28040 "	5.44 "
30 "	457 "	32010 "	5.82 "
35 "	473 "	34500 "	6.19 "
40 "	487 "	37390 "	6.48 "
45 "	500 "	39850 "	6.78 "
50 "	511 "	42640 "	7.02 "

It will be noticed from the table that the energy stored up increases rapidly with the initial pressure and reaches very high values.

Hot water forms a very economical, and at the higher pressures a comparatively light reservoir of energy. Referring to the table, it will be seen that at an initial pressure of 32 atmospheres (460 lbs. per sq. in.) the energy per pound of water is practically 1 h.p.-minute, so that 60 lbs. would contain 1 h.p.-hour.

This thermal system of vehicle propulsion depending upon a central station supply of energy, it is interesting to compare it with the other two systems which are also thus limited, the

electric and pneumatic (compressed air) systems. To get the actual weight per horse-power-hour of the power storing apparatus, we must add to the weight of water, found above, the weight of the retaining vessel. The latter, in order to withstand the high pressures, has to be rather heavy. At the above pressure and a factor of safety of 5 the weight of the retaining vessel would just about double the weight per horse-power-hour, making it 120 lbs. Electric storage batteries, built especially light for motor vehicle service, weigh about 75 lbs. per horse-power-hour of available energy, while the storage tanks for compressed air weigh considerably more.

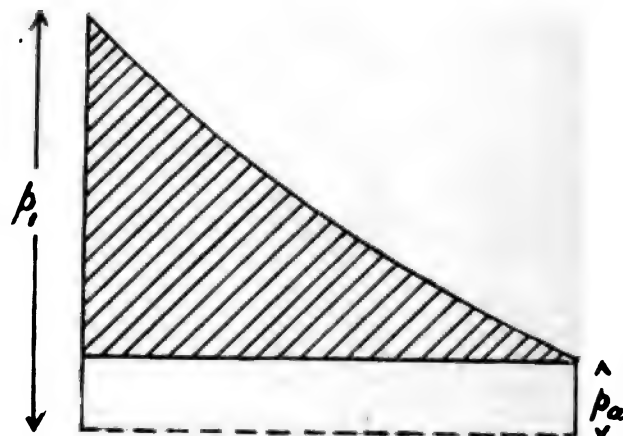


FIG 2.

The central station machinery required with the thermal system is much less than that required for either of the other two systems. While the former simply requires a boiler plant, the latter require boilers, engines, dynamos and an extra set of batteries, and boilers, engines, air compressors and large storage reservoirs respectively. There is of necessity considerable waste of energy in this additional machinery.

There is this similarity between the thermal and electric systems, that as long as there is any amount of energy left the pressure on potential remains the same; in other words, the amount of power available is practically independent of the energy or charge remaining in the reservoir. This is a very valuable feature, which is not possessed by the compressed air system.

In the matter of power storage reservoirs the thermal system resembles the pneumatic system, while both would seem to be considerably superior to the electric system. This comparison is made from the point of view of first cost and maintenance.

Coming now to the question of motors, it is well known that on motor vehicles a rotary motor is preferable to a reciprocating engine, as the former when properly balanced avoids all vibration. With the thermal power storage system either a reciprocating engine or a rotary motor (turbine) may be used, and the patent of MM. Hutin and Leblanc refers especially to a multiple steam turbine and the manner in which it is connected to the driving axle. The multiple expansion plan has to be followed in order to obtain economical operation at such high pressures.

To keep the temperature of the water constant, it is proposed to send air, heated by a small flame, through a jacket around the reservoir.

Gearing and Tires.

Pendleton, Ore., July 15, 1899.

Editor Horseless Age, New York.

Dear Sir:—Would you be kind enough to let me know through the columns of your valuable journal, the Horseless Age, the following information and oblige:

It being a hilly country out here, I would like to know if a person would use a low-gear on a bicycle, would it make it any easier riding or not? My present wheels are geared 63-in., and if it could be done. I would like to change it down to, say, 40-in.; so be kind enough to let me know what sized sprocket I would have to have to gear down to 40 in.; or would it be still easier riding with a lower gear than 40-in.? Would it also make any difference with the crank whether a person would use 6 or 7½? Please explain fully through the columns of your valuable journal. Let me also know if there would be any difference in single or double tube tires, to make riding easy in a hilly country. We have one hill right north of Pendleton which raises nearly 700 feet to 1½ miles. Could you also let me know, through the columns of your journal, if there is any make of motor which could be attached to any ordinary bicycle, say about a ½-h.p. motor? If there are such motors in the market I would like to get prices and full information on same, as, if I could I would like to range my bicycle with such motor.

Yours very truly,

JOHN D. PENCK, Pendleton, Ore.

P. S.—I must say the more I read your valuable journal the more I like it. I can't wait until each number arrives.

J. D. PENCK.

ANSWER.

1. If work at the cranks be regarded as pressure multiplied by distance, then the total will be the same whether the rider exert heavy pressure on short cranks moving in a small circle or light pressure on long cranks moving in a large circle. The writer would prefer a short crank as requiring less knee action; a taller rider could, however, manage a longer crank with equal ease. Considerable ink has been shed during the last few years regarding the relative advantages of high and low gears, long and short cranks, etc.; no machine can give back more energy than is given to it, and, no matter the gearing, it may be roughly set down that "what is gained in power is lost in time." If a bicycle is to be used for any other than the purpose of climbing hills a 56-gear would seem low enough; nor is there any noticeable advantage in single or inner tube tires, or vice versa, so far as hill-climbing is concerned.

To calculate the gear, the diameter of the rear wheel, in inches, is multiplied by the number of teeth in front sprocket and divided by the number of teeth in rear sprocket. For example, if rear wheel is 28 ins., front sprocket 20 teeth and

rear sprocket 10 teeth, then $\frac{28 \times 20}{10} = 56$ gear.

Usually the front sprocket is the one changed when altering gear, as the rear sprocket is often an integral part of the hub. To ascertain the number of teeth in front sprocket for any gear desired, multiply the gear by the number of teeth in rear sprocket and divide by the diameter in inches of the rear wheel. With a 28-in. wheel and a rear sprocket with 7

teeth, what number of teeth in front sprocket will give a 40-gear?

$$\frac{40 \times 7}{28} = 10. \text{ Ans.}$$

In order to determine the answer in any case, three of the terms must be supplied; and as only the gear is given in the query, the writer has furnished the above rules, from whence the desired information can be calculated for any particular bicycle.

2. Mention of firms, having the construction of small outfits for motor cycles under consideration, has been frequently given in the columns of the Horseless Age. For instance, page 8, May 17, 1899; page 15, May 24, 1899; pages 9-10, June 7, 1899; page 11, July 5, 1899; page 20, April 5, 1899, have addresses, etc., of manufactures. ROBERT I. CLEGG.

MINOR MENTION.

B. J. Carter, Jackson, Mich., has built a gasoline carriage for himself.

The Richland Buggy Co., Mansfield, O., are building a motor carriage.

A new company—The Detroit Automobile Co.—is said to be in course of formation in Detroit, Mich.

The Milwaukee Electric Co., Milwaukee, Wis., is reported to have received an order for 150 vehicle motors.

James L. Eck, proprietor of the Boss Knitting Machine Works, Reading, Pa., has constructed for himself a steam carriage, employing gasoline for fuel.

The United States Motor Co., capital \$1,000,000, has been incorporated at Dover, Del., by Pittsburg and Allegheny capitalists to make and sell motor vehicles.

H. T. Hearsey, Frank Staley and Fred R. Willis, of Indianapolis, Ind., have bought out the carriage business of Fisk & Wood, of that city, and will open a motor vehicle depot there early in September.

Some excitement was caused in the English motor world on Tuesday by the announcement that Scott Montagn, M. P., who is an enthusiastic chauffeur, had been refused admittance to the Court Yard of the House of Commons, or rather that his Daimler carriage, on which he was riding, was not allowed to enter. The refusal, however, turned out to be a blunder by the policeman on duty, and henceforth Members of Parliament may proceed to the seat of their duties by horse or horseless carriage as they please.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

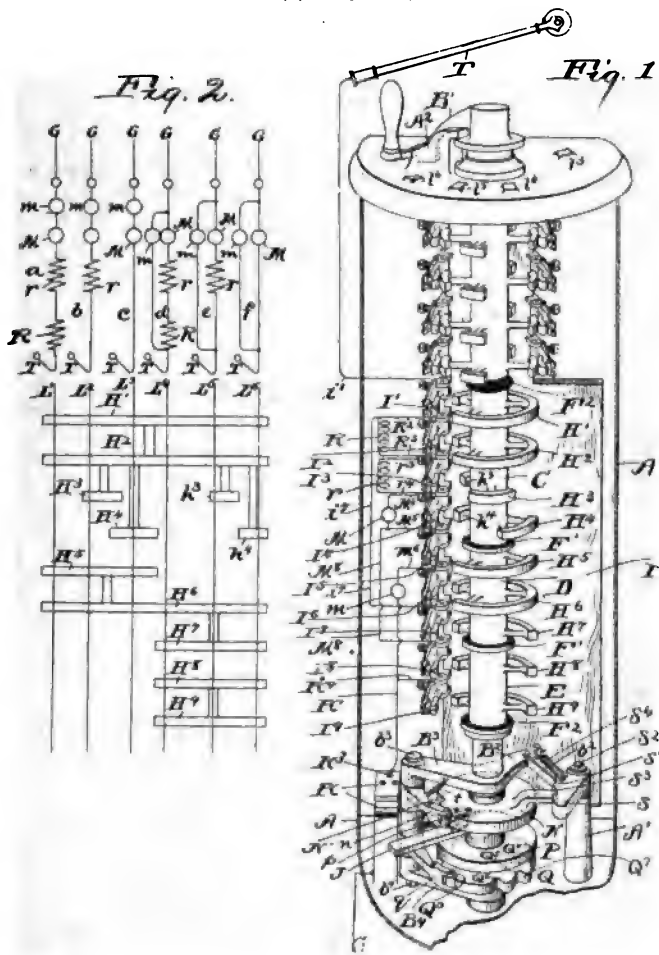
MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

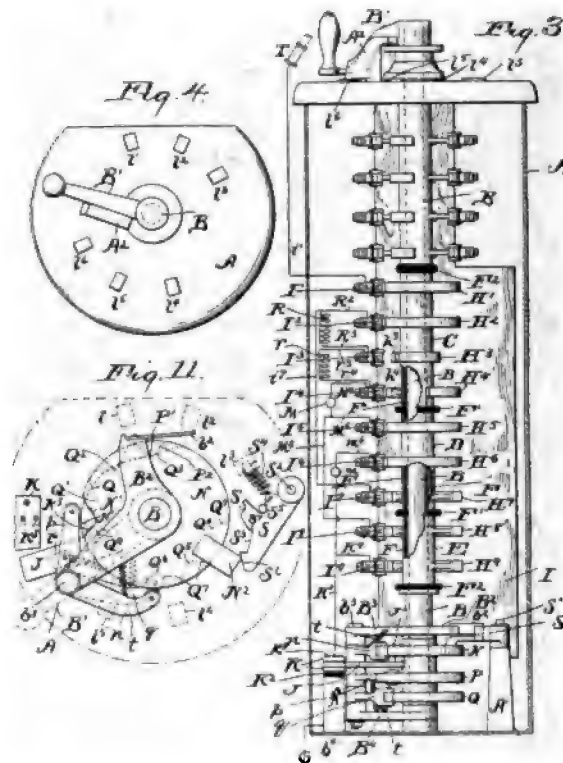
No. 629,398.—Controller for Electric-Motor Cars or Vehicles.—Sidney H. Short, of Cleveland, O., Assignor to the Walker Co., of New Jersey. Application filed July 25, 1899.

The primary object is to prevent arcing or sparking between the movable and relatively stationary contacts of the controller in breaking electrical engagement between said contacts.



A designates the case of the controller, centrally of which an upright shaft B is suitably supported. Said shaft extends upwardly through case A and is provided with a hand-lever B' at the upper end thereof above case A. Three sleeves C, D and E, arranged end to end, are rigidly mounted upon shaft B, C designating the uppermost sleeve, D the middle sleeve and E the lowermost sleeve. All of said sleeves are electrically insulated from the shaft by suitable insulating substance

or material F, interposed between the sleeves and shaft. The sleeves are also electrically insulated from each other by suitable insulating substance or material F', interposed between opposing ends of the sleeves. Sleeve C at its upper end and sleeve E at its lower end are electrically insulated from the supporting-shaft by suitable insulating substance or material F². Each sleeve is provided with any suitable number of segmental contacts located at suitable intervals endwise of the supporting-sleeve and arranged concentrically with the axis of the supporting-shaft, said contacts being rigid with and preferably integral with the supporting-sleeve. Sleeve C is shown provided with six segmental contacts, marked H¹, H², H³, H⁴, H⁵ and H⁶, respectively, and all of said contacts except contacts



h¹ and h¹ are arranged in different horizontal planes, respectively. Contact h¹ is arranged in the same horizontal plane with contact H¹ and contact h¹ is arranged in the same horizontal plane with contact H¹. Sleeve D is shown provided with three segmental contacts (marked H², H³ and H⁴, respectively), and said contacts are arranged in different horizontal planes, respectively. Sleeve E is shown provided with two segmental contacts H⁵ and H⁶, respectively, arranged in different horizontal planes, respectively. Contacts H¹, H², and H³ have the same or approximately the same length and are arranged in the same vertical plane.

A series of relatively stationary contacts is provided on one side of and a suitable distance from shaft B, said contacts being preferably arranged in a vertical row. Nine of said relatively stationary contacts I¹, I², I³, I⁴, I⁵, I⁶, I⁷, I⁸ and I⁹ are provided in the case illustrated.

Stationary contact I¹ is electrically connected by wire i' with the trolley or contact device T of the motor-car, a resistance R has its opposite terminals electrically connected by wires R¹ and R² with contacts I² and I³, respectively, wire

R^2 , and consequently contact I^2 , is electrically connected by means of wire i^1 with contact I^1 ; another resistance r has its opposite terminals electrically connected by wires r^2 and r^1 with contacts I^2 and I^1 , respectively; a motor M has its opposite terminals electrically connected by wires M^4 and M^5 with contacts I^4 and I^5 , respectively; wire M^3 , and consequently motor M , is also electrically connected by wire M^2 with contact I^2 ; another motor m has its opposite terminals electrically connected by wires m^2 and K^1 with contacts I^1 and K , respectively; contact K is suitably supported in the lower portion of, but electrically connected from the controller-case, and wire K^2 with contact I^1 .

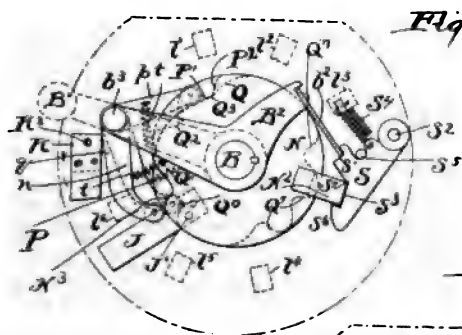


Fig. 5.

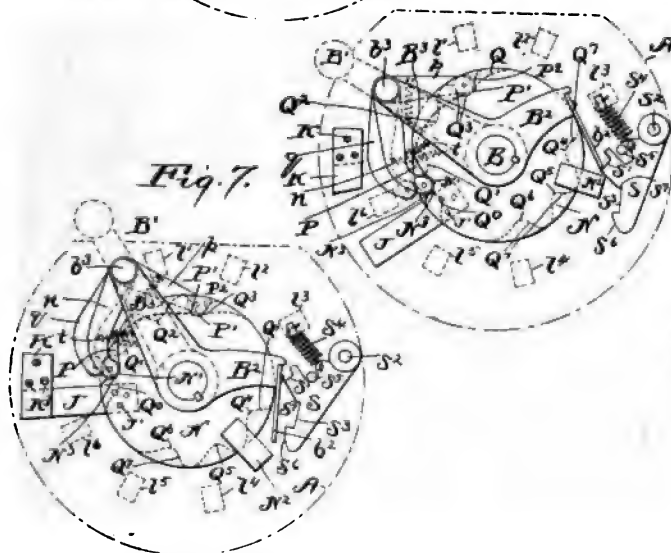


Fig. 6.

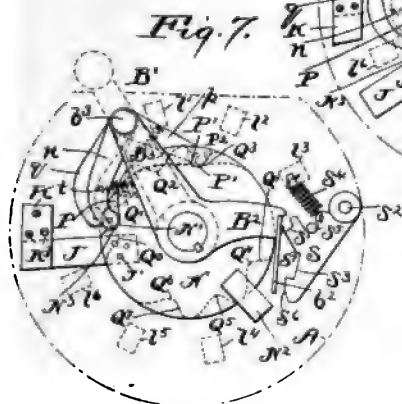


Fig. 7.

G designates a wire leading to ground or return-conductor and electrically connected with a circuit-breaker J , that is provided in the lower portion of the controller-case and closes or breaks the circuit between the motors and ground or return-conductor, according as said circuit-breaker is caused to electrically engage or disengage contact K .

On top of the controller-case is an index consisting of six marks—such, for instance, as lugs (designated I^1, I^2, I^3, I^4, I^5 and I^6 , respectively), which lugs or marks are arranged at suitable intervals in the path of the operating-lever and are formed in any suitable manner upon the top of the controller-case.

Three disks N, P and Q are loosely mounted upon shaft B in the lower portion of the controller-case. Said disks are rigid or integral with each other. N designates the upper disk, P the middle disk, and Q the lower disk. Disk N has a peripheral recess or depression N' and bears the circuit-

breaker J , hereinbefore referred to. Disk P has a peripheral depression or recess P' , and disk Q has as many peripheral recesses or depressions as and preferably one more than there are lugs or index-marks upon the top of the controller-case. Disk Q has seven peripheral depressions or recesses, Q^1, Q^2, Q^3, Q^4, Q^5 and Q^6 . Shaft B at any suitable point between disk N and the insulation F^2 at the lower end of sleeve

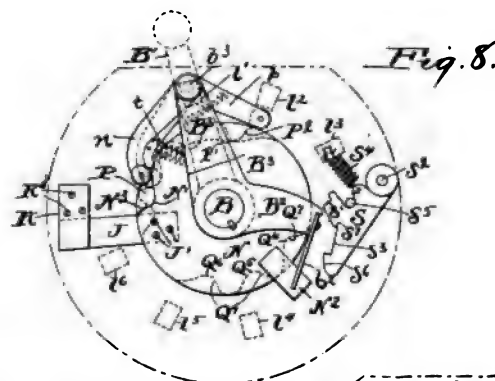


Fig. 8.

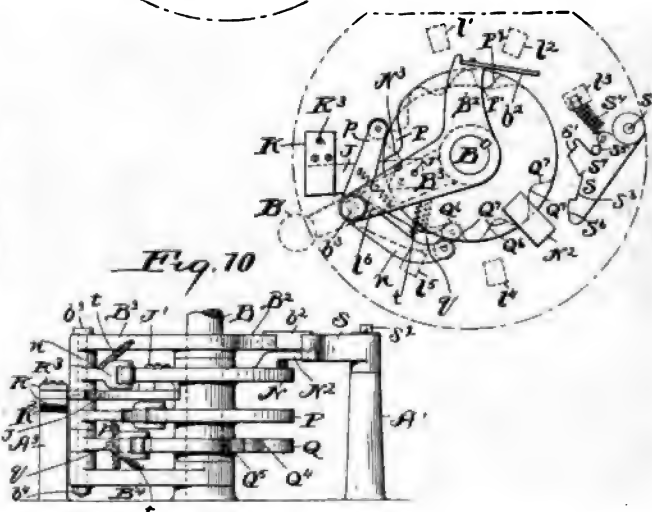


Fig. 9.

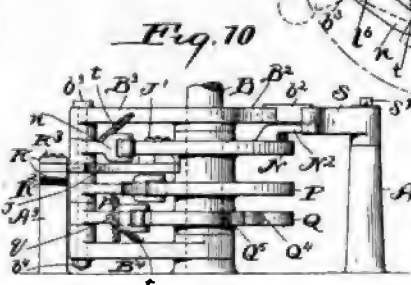


Fig. 10.

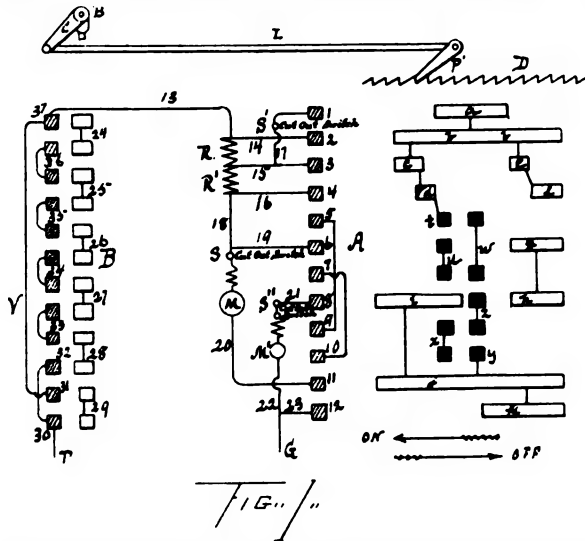
E has a laterally-extending arm B^2 , adapted to engage a shoulder S' , formed upon a latch S , and actuate said latch from an operative to an inoperative position. Latch S is fulcrumed at S^2 , to a lug A^1 , and has a recess S^3 . A spring S^4 acts to retain latch S in its normal or operative position, opposite ends of said spring being shown attached to the latch and controller-case, respectively. A stationary pin or stop S^5 , limits the action of the aforesaid spring. Shaft B is also provided with two laterally-extending arms B^3 and B^4 , arm B^4 being operatively connected with the shaft at any suitable point below disk Q and arm B^3 being operatively connected with the shaft at any suitable point between disk N and adjacent insulation F^2 . Three pawls n, p and q are pivotally supported from and between the outer ends of arms B^3 and B^4 .

No. 629,399.—Controlling Apparatus for Electric Motors.—Sidney H. Short, of Cleveland, Ohio, Assignor to the Walker Company, of New Jersey. Application filed July 25, 1899.

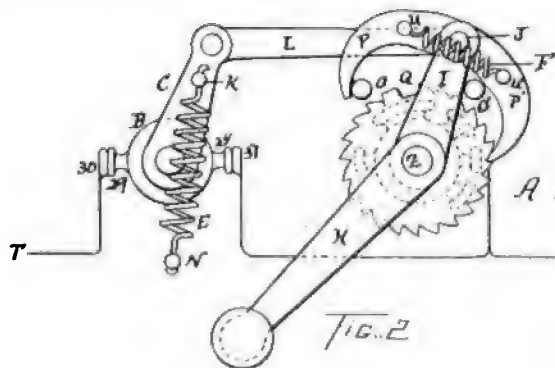
The invention relates to controlling apparatus for electric motors, traction and otherwise. These motors may be used singly, in pairs, or any number of motors may be arranged to be controlled from the same controlling apparatus. The

main object is to avoid the destructive arcing usually resulting when making the changes in combinations or in cutting off the current from the motor or motors.

The controller consists of two parts—that part A which forms the combinations in the motor-circuit and cuts in and out resistances, and another part B intended to dissipate the arc which is formed at the moment of breaking contact. The



part A consists of a cylinder upon it metallic contact-plates arranged to come in contact with and connect various stationary terminals, while the part B is a separate cylinder arranged simply to make and break contact. The part B consists of a series of stationary contact-plates marked 30, 31, 32, 33, 34, 35, 36 and 37, each of these, except 31 and 37, being arranged in pairs. The moving part carries a series of corresponding contact-plates ranged in pairs—24, 25, 26, 27, 28 and 29—the parts 24 to 28 being arranged to come in contact with the corresponding stationary contacts a little before the contact 29 comes in contact with 30 and 31 and to break a little later than contact 29 when turned in the reverse direction. The contacts 31 and 37 are connected by a conductor V, 30 is connected to the trolley, and 37 is connected by line 13 with the motor-circuit.



M M' represent two motors, and R R' represent two resistance-coils.

S, S' and S'' represent cut-out switches by which either of the motors may be cut out of circuit.

The main controlling-switch A has on it a series of contact-plates a, b, c, d, e, f, g, h, i, j and k, which are connected, as shown, and it also has a series of other contact-

plates t, u, w, x, z and y (shown in black), which are intended mainly for the purpose of dissipating the arc which forms in the controller at the time of breaking contact.

The top of the controller is provided with a ratchet-wheel D, which is moved by the handle H in either direction as the controller is moved. The top of the movable part of series break B is provided with a crank C, and a spring E is attached at one end to a pin K on said crank C and at the other end to a stationary pin N in any convenient part of the controller-box, so arranged that when crank C is moved from the position shown in Fig. 2 to the left said spring will swing across the centre line of crank C, and thus tend to throw said crank in one direction or the other on the well-known principle of the double-acting spring-hinge.

I represents an arm which is loosely pivoted at one end to the post Z, to which controller-crank H is attached, and at its outer end is connected by a link L with the end of crank-arm C.

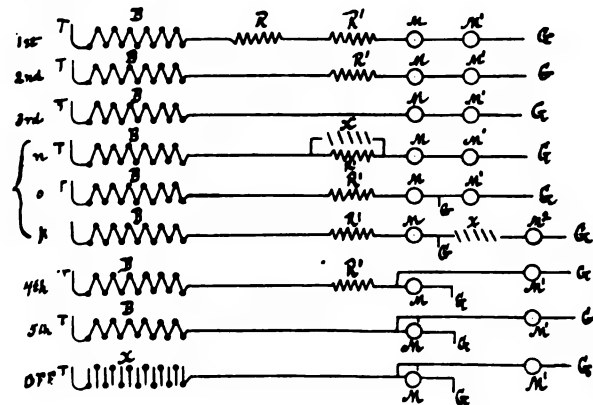


FIG. 3

P and P' represent two curved pawls, each pivoted on the pin J, which connects arm I with link L, and drawn together by a spring F, whose line of strain is between said pin and the inner end of arm I, so that said pawls are normally always drawn toward each other.

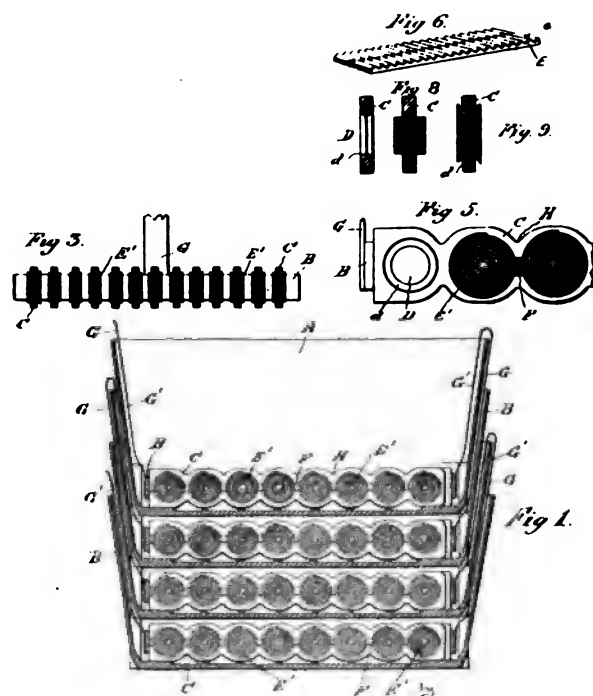
O O' represent stationary pins on the controller-case adapted to come in contact with pawls P and P', respectively, and hold them out of engagement with ratchet-wheel D.

Q represents a lug on ratchet D, adapted to strike the end of pawl P, so as to shift the pawl into the position shown in Fig. 2.

From the foregoing description it will be seen that there is an initially-acting switch having operative connection with the circuit-changing and resistance-varying switch, the arrangement being such that the first movement of the last-mentioned switch—that is, the controlling-switch—in one direction—that is, in a direction toward the "on" position—operates to close the first-mentioned or initially-acting switch and that said initially-acting switch is maintained in closed position during the entire "on" movement of the controlling-switch, and hence during the circuit changes and resistance variations in the motor-circuit. It will also be seen that the first movement of the controlling-switch in the opposite direction—that is, toward "off" position—operates to open the initially-acting switch remains in open position during the entire "off" movement of the controlling-switch.

No. 629,371.—Storage Battery.—Charles W. Kennedy, of Rutledge, Pennsylvania, Assignor, by Mesne Assignments, to the Electric Power Development Company. Application filed July 25, 1899.

The drawings show the improvements as applied to a storage or secondary battery of one of the forms now well known; but the cells or cups can be of any well-known form. Those illustrated are cups A of hard rubber, they having their side walls flared upwardly to rest directly one upon another. In these cells are placed the electrodes having the features of improvement. The structural features of the positive and negative electrodes of each couple are substantially the same. There is a frame or carrier consisting of the bar B and bars C, secured to and extending transversely thereof, the latter bars being unsupported (and separated from each other) at their outer ends. Each bar C is formed with a series of apertures D of relatively large diameter and as closely together as possible. In these apertures are placed "pellets" or masses of active material. The latter are formed from strips of lead tape, such as shown at E, of which suitable lengths are taken and bent to form tight coils. Prior to the coiling they are subjected to the action of corrugating devices, preferably of the form of a ribbed roller working in opposition to a companion roller and by means of which comparatively sharp and well-defined V-shaped grooves e are formed in one or both surfaces of the tape. After a coil of sufficient diameter has been formed it is driven tightly into one of the apertures at D. The edge of the aperture is preferably flared or beveled somewhat, as at d, this making ample provision for the expansion of the lead, which, as is well known, occurs after the commencement of the electrolytic action.



The corrugations and grooves on the surface of the tape provide a great number of minute passage-ways through which the electrolyte liquid can freely circulate, and thus reach every point of the surface of the lead.

There are metallic pieces F F closely joined to the metal of the pellets and preferably united also to the metal of the electrode bars or arms. After the pellets are inserted and before being put into use their wider outer or exposed faces may be enlarged by mechanical means, if desired, as by pressure, so that said faces shall be wider than the aperture in which they are inserted. whether this widening is thus effected or results from the electrolytic expansion, it insures that the pellets shall be firmly locked against escape from the bars or plates.

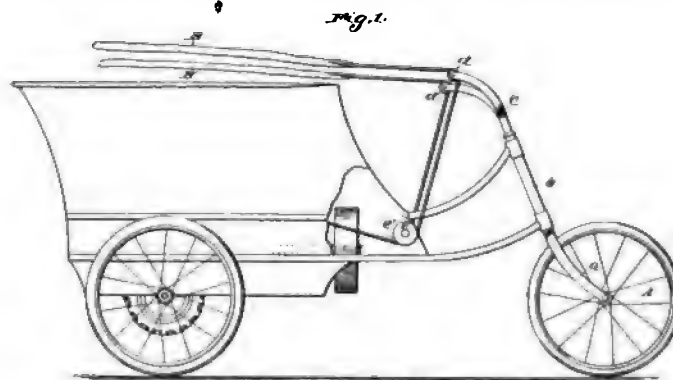
Only sufficient solid metal is retained to furnish what may be regarded as a series of ring-like holders, and the proportion of the active metal to the inactive is greatly increased. The arms or bars of the negative electrodes alternate with those of the positive, all lying in substantially the same horizontal planes, and the bottoms of the cells can be brought close together, the result being a great reduction in weight and economizing of space. The positive and negative electrode bars are spaced and held apart by insulators, such as shown at K.

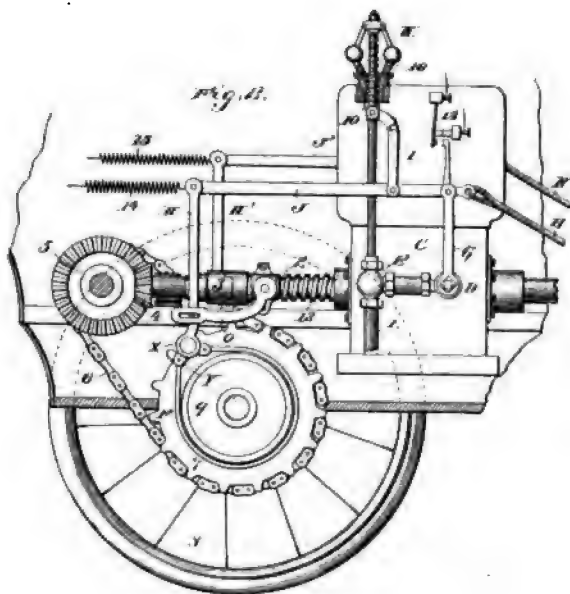
No. 629,521.—Motor-Vehicle.—Lucius J. Phelps, of New Jersey. Application filed July 25, 1899.

The object is to secure the perfect control and handling of a motor-vehicle by means of a pair of reins in the hands of a driver located in an independent vehicle drawn by the motor-vehicle.

A is the steering-wheel, mounted in fork a, pivoted in the steering-head b and terminating in the forked handle-bar c. The two extremities of the handle-bar are fitted with sheave-wheels d and d', through which the reins B and B' pass, and from thence downward and through the sheave-wheels e and e', attached to the frame of the vehicle, to the interior, where they are attached to the controlling mechanism, as herein-after described.

C is a petroleum-motor of ordinary construction. The power is transmitted from the same through the driving-shaft 2, clutch-coupling 3, beveled pinion 4, bevel gear-wheel 5, and chain 6 to the sprocket-wheel 7, attached to the axle of the two main driving-wheels 8, only one of which is shown in the drawing. L is the feed-pipe through which the explosive mixture is drawn to the engine. D is a throttle-valve situated in the feed-pipe L for the purpose of controlling the intake of explosive mixture at the will of the driver. E is a valve in feed-pipe L and controlled by the governor K for the purpose of automatically regulating the speed of the engine. F is a brake-shoe encircling brake-wheel 9, which is rigidly attached to the axle of the driving-wheels 8. H and H' are levers, rigidly attached to rocking shaft X, which carries the lugs Y and Z, which are pivotally attached to the





brake-shoe F. G is a lever rigidly attached to the throttle-valve D at its lower end, and its upper end is attached to the horizontal lever J, to one end of which the rein B is attached, and its opposite end is attached to the upper extremity of the lever H, the rein B' being attached to the lever J' in like manner. I is another lever, one end of which is pivoted to the horizontal lever J, and its opposite end is pivoted to the collar 10, which moves freely upon the governor-rod 11, and by its action controls the speed of the motor by varying the tension of the governor-spring 16. O is a lever connecting the lever H with the movable portion of the clutch-coupling 3 and slotted at its rear end to allow the free movement of the lever H within certain limits; 12 is a spring adapted to normally keep the clutch 3 closed.

The explosion of the mixture within the engine-cylinders is produced by an electric current which is passed through the contact-points 13, and this contact is adapted to be broken by the lever G if it moves backward beyond its normal position, as shown in Fig. 2, thus stopping the engine instantly.

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AUGUST 16, 1899

NUMBER 20

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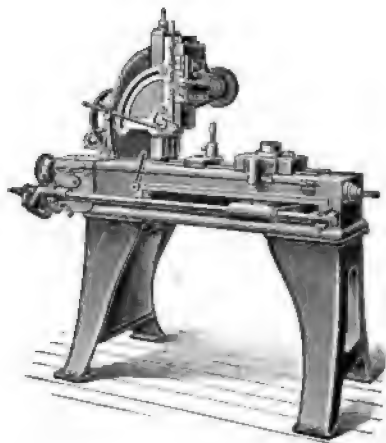
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Vol. IV.

NEW YORK, AUGUST 16, 1899.

No. 20.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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Motor Farm Wagons.

In the practical application of the motor wagon to the various industrial needs of the world England is making rapid headway. Our London correspondent in this issue informs us of the example set for the entire world by an English farmer who has ordered of a well-known English manufacturing company three gasoline motor wagons, which he proposes to employ for the transportation of farm produce to the London market, having satisfied himself that a saving can be effected over the present method of railway transportation.

In this case, and in numberless similar cases, the element of time enters largely into the calculation. The haul from the local railway station to the railway terminus is a comparatively short one, yet the same amount of handling and teaming is required to get the produce to market as would be required if the merchandise were shipped across the American continent. This saving of time and cost of rehandling alone changes the

balance in favor of the motor vehicle for short distance transportation. In long distance transportation, of course, the problem is quite different, and would work out overwhelmingly in favor of the railroad, but in the cartage of farm produce to a nearby market the motor wagon has an almost undisputed field.

The step which this enterprising English farmer has taken is in no sense a venture. It is a sound business economy, which will be amply justified in the outcome, and if the manufacturers will from this time pay a little more attention to motor wagons and a little less to automobiles they will be developing the more substantial and more promising branch of the industry. There is more work than pleasure in the world.

Sir David Salomons' Letter.

Sir David Salomons' letter to the Automobile Club de France, in reference to the Gordon Bennett International Racing Cup, is worthy of the attention of that body. The two suggestions it embodies will receive the general approval of all interested in the sport of motor racing. In the drafting of the rules which are to govern the races and the awarding of an international cup it would seem only fair that all clubs eligible to compete should have a voice. For their own information the committee of the Automobile Club de France should seek the co-operation of similar organizations in order that the fullest light may be shed on the important matters they have to decide.

The second suggestion is equally timely. Why the donor of the cup should have limited the competition to electric and gasoline vehicles is not clear. It is apparently an unnecessary and unwise restriction. The best interests of the sport will be subserved by opening wide the gate to all comers, whatever the motive power used, provided, of course, the vehicle is not inherently dangerous, an exception which is always implied in motor discussion.

Axles.

Builders of motor vehicles are learning that great care is necessary in the selection of the material for their axles. Numerous cases of breakage of axles have been traced directly to the use of steel of too high carbon, in one instance that came under the notice of the editor, as high as 70 per cent. carbon, which quickly crystallized when subjected to the vibrations of the road, and broke off with a clean break, showing in the grain its unfitness for the purpose.

What is wanted in a motor vehicle axle is toughness to withstand successfully the strains and vibration of the road. A low carbon steel, say 20 to 30 per cent., that will yield and return to the normal without much loss of strength, is the grade required for this service. Forged nickel steel, the toughest steel known, appears to be well adapted to the work, and manufacturers should look into its merits. The axle is one of the parts they cannot afford to slight.

Axle Bearings.

Load and end thrust are the two chief sources of friction and wear in the motor vehicle axle. As to the relative importance of them, opinions may differ, but it will probably be admitted by all who have followed the history of invention in this line that the load is easier taken care of than the end thrust. Various contrivances, more or less ingenious, have been devised to receive these end strains, which are the more difficult to counteract because they are intermittent and vary so greatly in intensity. We shall shortly lay before our readers a special article going into the history and philosophy of this subject thoroughly. Meantime, any of our readers who have theories or practical experience in relation to motor vehicle bearings are invited to contribute to our columns.

Freight Rates.

The motor vehicle, being a new article of manufacture, has not yet come under the notice of the classification committees of the railroads, and a wide difference in freight charges is reported from various sections of the country. A gentleman who had occasion to ship a motor carriage from Omaha to Indianapolis states that he was obliged to pay \$40 freight on it, and that he could have saved a portion of this cost if he had taken the vehicle apart and made two or three separate shipments.

The subject of freight charges is one which should be brought to the attention of the railroad authorities immediately, in order that a fair and uniform scale of charges may be determined upon. The editor will be glad to hear from manufacturers in regard to this matter, and will present the facts to the Classification Committee without delay to open the discussion.

Steel Stampings.

Some makers of steel stampings for bicycles expect a demand for their process from manufacturers of motor vehicles, contending that stamped steel parts are as strong and cheap, or cheaper, than forgings. A careful examination of a number of motor carriages failed to reveal any number of parts that could be stamped with advantage. Possibly on the lightest machines stampings might be used instead of forgings, but the forging seems to be preferable in nearly all cases.

If any manufacturer of steel stampings will point out the parts of a motor carriage that he thinks could best be made by his process, and why, the editor of *The Horseless Age* will take pleasure in laying the communication before his readers.

The Transcontinental Tourists.

The adventurous couple who are endeavoring to make "San Francisco or bust" in a motor carriage have apparently taken the latter alternative. At the rate at which they are traveling they could not reach San Francisco in less than five months from the date of setting out, and at the rate at which they are "busting" they would have an entirely different carriage if they ever reached the Pacific Coast.

If the unfortunate experiences of this couple shall do anything to discourage similar enterprises in the future their troubles will not have been wholly in vain. An immediate termination of the journey would be welcome by the motor vehicle industry of the United States.

Educated Purchasers.

It is important, in the early stages of an industry like the motor vehicle industry, that the manufacturer should sell his product to educated purchasers who have studied the mechanical phases of the new vehicle and are competent to use and care for it properly. The abilities and habits of the owner are as much to be taken into account as the merit of the vehicle itself in deciding its fate in the hands of the user. Every machine requires more or less attention if it is to perform its work satisfactorily, and reckless or careless handling will surely bring misfortune in their train, no matter how well the manufacturer may have done his part.

The reputation of the manufacturer and the welfare of the industry will be best conserved by a wise selection of customers, confining sales as far as possible to those who do not expect too much of a motor vehicle and who will exercise judgment in the use and care of it. *The Horseless Age* has on its subscription books hundreds of such would-be purchasers, with whom it can bring its advertisers in touch.

The Size of the Compression Space Necessary for Gasoline Engines.

By A. M. Herring.

For determining the size of the compression space of a gas or gasoline engine a number of things have to be taken into consideration, and the best designed engine in this respect is in the end the best practical compromise between what ought to be done theoretically and what must be done mechanically. The theoretical considerations (i. e., most power for the least consumption of fuel and, incidentally, the least size of cylinder) all point to the side of the smallest possible compression space. This, of course, entails the disadvantages due to a greater percentage of leakage at the enormous explosion pressures. But leakage past the piston and rings of an engine built according to the most advanced knowledge can be reduced almost to a negligible quantity. Fits of piston and rings to withstand satisfactorily pressures in excess of 400 lbs. per square inch can, however, not be attained (on a commercial basis) on an ordinary lathe. Such work ought to be done on grinding machinery; the rings especially require such treatment after being cut in order to secure perfect contact all around the cylinder. As such work is a question of proper tools rather than extreme skill of labor we may dismiss the question of leakage at this point by the statement that a gasoline engine, if properly constructed and properly lubricated, will not waste any appreciable amount of power in leakage at any pressure we would be able otherwise to employ. The compression of the gasoline vapor and air (or any gas) produces heat; we can therefore work with a compression up to the point where the heat produced is enough to light the mixture. With very weak mixtures (mixtures so weak in gasoline that they cannot be exploded at all unless compressed), the compression of course can be carried to a higher point than if the ordinary "good running mixture," about 1 to 8 or 1 to 9, is used. Leaving out of consideration engines of the Diessel type and considering only the ordinary or Otto Cycle engines, fitted with the usual means of adjusting the mixture and with a fixed time of ignition, we cannot have a higher temperature of compression than about 700 degrees Fahrenheit without premature explosion, which corresponds to a pressure of about 220 lbs. per square inch above the air, and at the moment of explosion to something in the neighborhood of 1,000 lbs. per square inch. The compression space in such an engine, if very fast running and provided with very large valves, would be about 13½ per cent. of the whole volume of the cylinder (including the compression space), in other words, 15.45 per cent. of the volume passed over by the piston. Such high compression is only practicable with dilute mixtures, and cylinders that are well cooled by free circulation of cold water. Perhaps the highest practical compression in unjacketed engines would be not far from 200 lbs. per square inch, which entails a compression space of about 17½ per cent. of the piston displacement. Such an engine is easy to ignite even with mixtures which will not work satisfactorily in most engines (which have much lower compression). The drawbacks, however, are that the pressure at explosion is very high—it may reach nearly 900 lbs. per square inch. The net working pressure will, however, be higher too, but not in the same proportion. The chief drawbacks are the much greater weights of shaft, connecting rod,

frame and fly-wheel necessary, and, above all, the greater effort required to start the engine, for if the compression is relieved beyond a certain limit the energy of the first explosion will not be sufficient to produce the succeeding compression and thus keep the engine going.

For practice the compression space for vehicle motors is often as large as one-half the stroke of the piston, and although this means the consumption of about double the gasoline for the same power, and makes ignition more difficult and uncertain and the motor as a whole heavier than it might be, and entails greater necessity of cooling, it still has its advantages—it works satisfactorily (?) in cheaply built engines. Where minimum weight of the engine as a whole (including fly-wheel, etc.) is looked for, a compression space of one-third to one-fourth the volume passed through by the piston is about as small as should be used. This entails explosion pressures from 400 to possibly over 500 lbs. per square inch.

Diamond Flat-tread Motor Pneumatic.

About the only rubber company in the United States which has made a special study of the needs of the motor vehicle manufacturers is the Diamond Rubber Co., Akron, O., who have recently put out a tire of unique design, which they call their Diamond Flat-Tread Motor Pneumatic.

The peculiarity of this tire is in the flat, thick shoe, which gives increased traction and strength, decreases the liability to puncture and adds but little weight.

Very successful tests have been made on different types of motor vehicles, 30 per cent. more mileage having been secured than can be covered when the ordinary pneumatic is used.

These flat-tread tires are made in sizes from 28x2½ up to 36x5 inches, and, in common with all the Diamond pneumatics, have rubber between the plies to hold the lugs in place and prevent the plies from separating, and also to keep out moisture in case the outer shoe is cut.

MINOR MENTION.

A report is current this week to the effect that the Prince of Wales has ordered a motor victoria.

A company with \$200,000 capital is to be organized at Lorain, O., for the manufacture of motor vehicles.

Mr. Baker, of the American Ball Bearing Co., Cleveland, O., is building an electric carriage that will not weigh over 300 lbs. The battery will weigh about 175 lbs.

According to the daily newspapers, the Austrian Minister of Commerce is reported to be contemplating the introduction of motor-carriages for the conveyance of mail bags to and from the railway stations, as well as for the delivery of the parcel post and the collection of letters from pillar boxes.

Among the bicycle manufacturers who are experimenting with the motor vehicle are: E. C. Stearns & Co., Syracuse, N. Y. (electric); Kensington Bicycle Co. and the Geo. N. Pierce Co., Buffalo, N. Y. (gasoline); Acme Mfg. Co., Reading, Pa. (gasoline), and the Gormully & Jeffery Mfg. Co., Chicago, Ill.

Rules for the Gordon Bennett International Racing Cup.

The following is a copy of a letter sent to the secretary of the Automobile Club de France by Sir David Salomons, chairman of the Foreign Relations Committee of the Automobile Club of Great Britain:

"July 22, 1899.

"Sir: The committee of this club understand that Mr. Gordon Bennett in instituting an international automobile cup placed in the hands of your committee the framing of the regulations affecting racing for this cup.

"The committee of this club do not desire for one moment to interfere with the committee of the Automobile Club de France in the framing of those rules; but they have asked me to convey to your committee the hope that the Automobile Club de France may be so good as to call a meeting of delegates of the other recognized automobile clubs, in order that they may place before your committee, for consideration, representations as to provisions which might fittingly be incorporated in the rules. Possibly, in view of the fact that the cup is to be international, the committee of the Automobile Club de France may see their way to accede to this suggestion.

I am also desired to state that the committee of this club trust that the Automobile Club de France will approach Mr. Gordon Bennett with a view to an alteration of one of the conditions under which it is understood he is presenting the cup—namely: that competing vehicles should be confined to those propelled by electricity and motor spirit. It is hoped that the best influence of your committee will be used to induce Mr. Gordon Bennett to open the competition to all self-propelled road vehicles, irrespective of their motive power.

"I have the honor to be, sir,

"Your obedient servant,

"DAVID SALOMONS.

"Chairman of the Foreign Relations Committee."

The Holley Gasoline Carriage.

This carriage, built by G. M. Holley, of Bradford, Pa., is propelled by a single cylinder gasoline motor, cylinder $3\frac{1}{2} \times 4\frac{1}{4}$ in. It has no poppet valves, and all of its operations are smooth and without jamming or noise of any kind. The operations of the Otto cycle are performed by a rotary valve made of tool steel with seat of cast iron. An electric make and break ignitor is used. There is said to be no vibration from the engine when running in the carriage for the reason that the framework, carriage body and running gear are all bolted together, depending on large pneumatic tires for easy riding qualities.

Its complete weight with water and gasoline for 100 miles is 280 lbs. It has a hill climbing gear of 5 miles an hour, and a speed gear for a maximum of 24 miles an hour, so that by varying the speed of the motor any speed from 2 to 24 miles an hour can be obtained. The wheels are 26 in. in diameter with $2\frac{1}{4}$ -in. tires. The carriage is very easy to get in and out of, the flooring being only 16 in. from the ground. The motor is automatically started by pressing a button. These carriages will be built at Bradford, Pa., and will be sold at a popular price.

Company Organized at Omaha.

Motor vehicle manufacturing companies are beginning to crop up west of the Mississippi. One of the most recent is the Omaha Gas Engine & Motor Co., of Omaha, Neb., organized under the laws of Nebraska, with a capital of \$150,000, to manufacture gasoline engines and motors, and also to build motor vehicles. The officers are: Henry C. Akin, president; H. K. Clover, vice-president and patentee; Dalton Risley, secretary; Dr. F. E. Coulter, treasurer, and O. E. Gugler, superintendent of the Union Pacific shops at Omaha, superintendent of construction. The company is just fitting up a factory, and expects to be turning out motors in 90 days.

The engines and motors which they will manufacture are the invention of Lieutenant H. K. Clover, of the United States Navy, a resident of Omaha, and a well-known mechanical expert.

The motor is a two-cylinder horizontal one, giving two impulses every revolution, using either gasoline or kerosene as fuel, and having but three moving parts—the piston, the crank shaft and the connecting rod. There are no valves in the cylinders—a butterfly valve controlling the supply of gas to both cylinders. The speed of the motor can be varied from 200 to 1,000 revolutions by means of a throttle valve that can be set in any position, the normal speed being about 800 revolutions. Its weight is 300 lbs., and its horse power 8.

The present cylinder is made of cast iron, but steel casting will be employed in future.

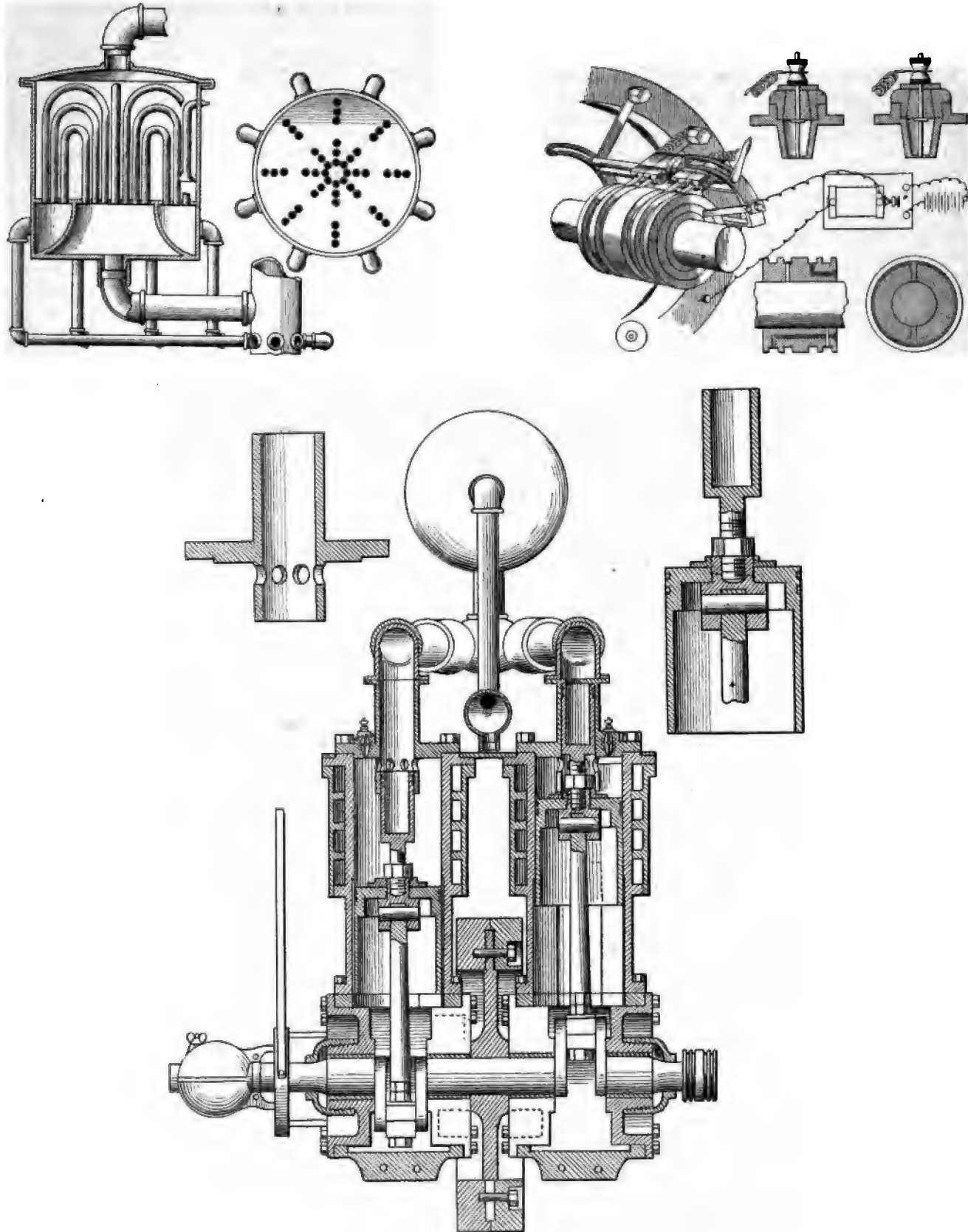
The exhaust is deodorized by passing through a preparation of magnesia, lime and charcoal, which is renewed every 30 days. The vaporizer is claimed as a special feature of this motor. A portion of the exhaust is used to dry the gas, and no air is taken in through the vaporizer, the air being mixed with the gasoline vapor just before entering the cylinder. The mixture is adjusted by a valve, which opens one port while it closes the other.

Electric ignition is employed, the jump spark being used for the motors, and the time of sparking being regulated by the brushes on the commutator.

A special patented attachment is furnished, to be applied to the motor when kerosene is to be used as fuel, and for mud or sand a special pneumatic tire in five sections, and resembling a Norwegian snowshoe. This consists of rubber shoes on each side, interwoven between with wire, and fastened on with set screws. Brass plates on the inside of the rim lock it securely in place. It is said that wheels so shod do not sink into mud or sand.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.



TWO-CYLINDER MOTOR.—OMAHA GAS ENGINE AND MOTOR CO.

Materials for Motor Vehicle Spur Gears.

By P. M. Heldt.

The transmission of the power from the engine shaft to the driving wheels has been, and remains, one of the most difficult problems in the construction of gasoline vehicles. The maximum driving force of a gasoline engine being practically the same as the force developed when the engine is running at maximum efficiency, the power derived from this type of engine is much less flexible than that produced by other motors used on motor vehicles, and although considerable advance has been made in recent years in the regulation of gasoline engines, still the speed control of gasoline vehicles has to be effected mainly by mechanical means.

Besides the ordinary high speed gear, at least one low speed or hill climbing gear has to be provided; and as the Otto cycle engine, which is at the present the most favored, and almost universal type, is non-reversible, practically speaking, a back-ing-up gear must also be provided.

To insure an excess of tractive effort, sufficient for all emergencies, the hill climbing speed is often made exceedingly low. This necessitates an additional gear, intermediate between the other two, which is used on all ordinary gradients, where the low gear would be too slow and the high gear not sufficiently powerful. The number of gears to be employed on vehicles of ordinary size varies, therefore, between three and four, and one has his choice of either using a very powerful engine and the smaller number of gears, or an additional gear and a somewhat lighter engine.

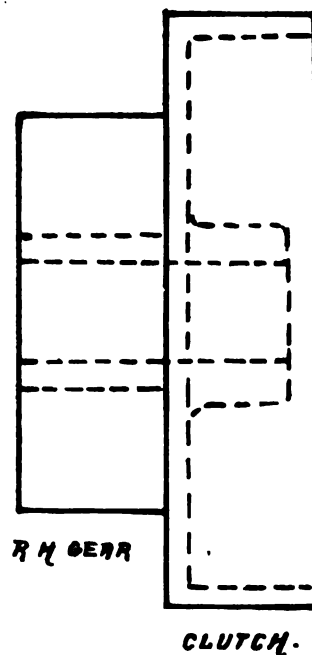
Belts, chains and sprockets, spur gears and friction drive devices, the latter both of the continuously variable and step cone types, have been used for transmitting the power in gasoline vehicles, but at the present moment spur gears seem to be gaining in favor. They have the advantages of greatest reliability and of compactness, which affords facility for encasing them. It is the object of this article to investigate the materials which may be used advantageously in the construction of these spur gears.

The first material which recommends itself by its strength is cast steel. This material has actually been used extensively, but there are a number of objections to it, both from the standpoint of the constructor and the purchaser of the vehicle. In the present state of the art, when motor vehicles are built rather than manufactured, the long time required to get steel castings from the foundry is quite a serious handicap. When motor vehicles are made in larger numbers and of standard construction this drawback will no longer exist, as a sufficient number of castings can always be carried in stock. Another serious objection to the use of cast steel is the unreliability of the castings with regard to soundness. A large gear wheel may be finished, and practically all the teeth cut, when a blow hole of sufficient size to make the gear worthless will show up.

Cast steel being a very tough metal, it is a rather tedious and expensive piece of work to cut the teeth, but this is, of course, compensated for by the longer wear of the gears. Cast steel is also very sonorous, and two cast steel gears running together at high speed produce a very objectionable ringing noise. At a pitch line velocity of 200 ft. per minute steel gears run comparatively noiseless, but the speed of even the slowest running gears in gasoline vehicles can hardly ever be reduced to this figure. At double this speed, or 400 ft. per minute, the noise emitted is very penetrating.

Cast iron does not possess the qualities especially desirable in materials for motor vehicle construction, viz., strength combined with lightness, but there are a number of parts for which it seems at present the most suitable material; for instance, engine cylinders and friction clutches. Clutches are sometimes constructed in such a manner that the inner surface of the rim of a gear wheel forms the friction surface for the clutch shoes. In such a case the use of cast iron is permissible and advantageous as far as the clutch part of the combination is concerned. The face of the gear wheels must, of course, be proportioned according to the strength of the cast iron.

Bronze or gun metal, and an alloy of 80 to 90 per cent. of copper with 20 to 10 per cent. of tin, has some qualities which render it quite suitable for gear wheels. The teeth are less liable to injury from shock than cast iron teeth; the metal is much less sonorous than steel, and is quite satisfactory as to wearing qualities.



The construction of gear transmissions is generally such that one member of a pair of gears is keyed to a shaft, while the one meshing with it runs loose upon its shaft. The latter must therefore be either of bearing metal or have a bearing metal bushing inserted in its hub. A bronze having a composition as given above will run satisfactorily upon a steel shaft. Some foundries make special bronzes of great hardness, but these do not always have satisfactory bearing-metal properties.

Pinions of small diameter of the plain type, i. e., without spokes and hub, are preferably made of round steel. This material, which is always easily obtained, is homogeneous and strong. The wear on the teeth of a pinion running together with a larger gear is necessarily considerably greater than the wear on the teeth of the latter, and it is therefore good practice to make the pinion of more lasting material to bring the length of life of pinion and gear nearer together. A steel pinion and a bronze gear running together in a bath of oil give very good results.

Rawhide pinions are very extensively used on electric vehicle motors, and consequently might also be used with gasoline vehicles. The only advantage of the rawhide pinion is its noiselessness at speeds at which metallic gears would not run noiselessly. These pinions are easily deteriorated by dirt, grit and oil, and are rather sensitive to moisture and changes of temperature. Their use should therefore be avoided wherever sufficiently noiseless operation can be secured by other devices. Rawhide pinions should run with none but steel gears.

A curious accident to a rawhide gear came to the writer's notice some time ago. The gear in question is part of the power transmitting mechanism of a heavy delivery wagon weighing with supplies and two persons about 4,500 lbs., and capable of a speed of 10 miles an hour. The gear is fastened to a cast iron friction clutch dressed as shown in the drawing. On the day the accident occurred the vehicle was being tested on the streets of Chicago. It was run a distance of about 5 miles continuously on the 10-mile gear on streets which are not particularly favorable to this speed. At this particular speed the gear is clutched to the shaft, but it does not transmit any power. For a number of reasons which it is not necessary to mention, the clutch slipped more or less continuously, and produced considerable heat, not enough, however, to cause any grinding or cutting of the clutch members. The proximity of the gear to the clutch permitted the transmission of a large amount of heat from the latter to the former. After the test had been finished and the lid was taken from the gear casing it was found that the rawhide part of the gear had contracted so much in diameter that the teeth were out of reach of the teeth of the metallic gear meshing with it, and a portion of the rawhide on the side of the gear next to the clutch had molten into a glue-like mass.

Studies in Ignition by Viator.

Among the many small troubles that beset the motor carriage of gasoline type none are more persistent and illusive than defects of the sparking mechanism.

Let us suppose a dynamo to be used with a battery also. One of the first troubles is that the copper brushes are frequently bent and thus thrown out of place by the sudden slight reversal of the engine at the time of stopping. The remedy is to use woven wire brushes. I say nothing of carbon, as I think small, low voltage machines should have no additional resistance to the current. In the clamp E E' fix above the woven wire brush a small bit of clock spring so curved that it exerts a moderate pressure upon the back of the brush where the latter touches the commutator A B. Brushes thus reinforced do not become loose in contact through road vibration.

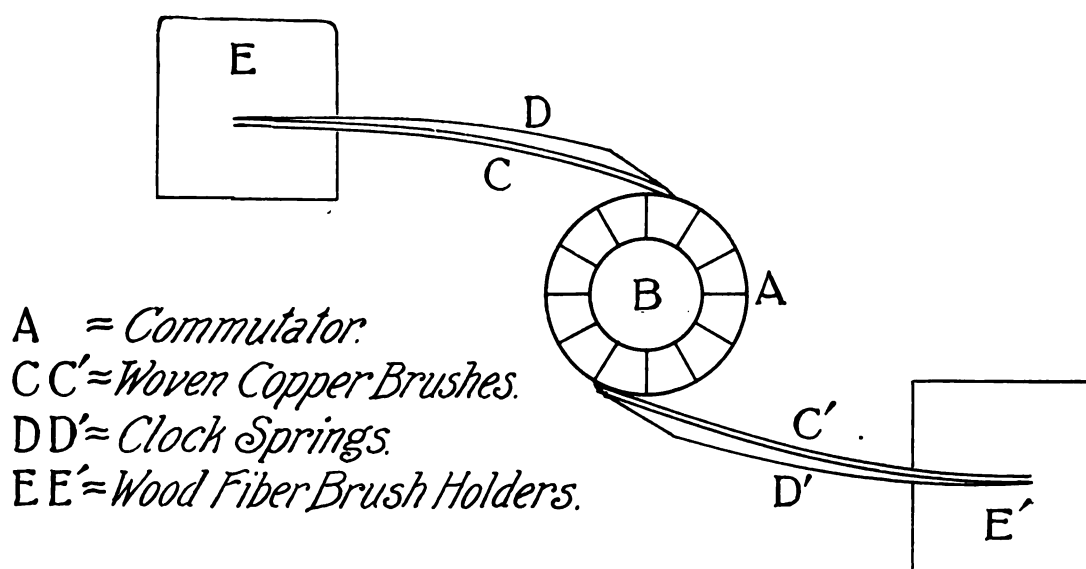
A second source of trouble is the dynamo belts, which are in constant need of attention: (a) they get loose; (b) they come unfastened; (c) the hooks, etc., make a noise; (d) they are spoiled by the heat and oil.

The remedy is to use a $\frac{3}{4}$ -in. flat belt and cement the ends together. Let the belt be of the kind known as rawhide—for example, that made by Schultz—and also mount the dynamo on a slide so that by means of a screw the belt may be adjusted exactly. Use on the dynamo a slightly crowned wood pulley with guides for the belt to prevent it from jumping off on bad roads. Place the dynamo as far as possible from the engine, as in this way the long belt drives much better.

A third source of trouble is the wires, which constantly break inside the insulation, as a result of the constant vibration. This is one of the greatest annoyances and is difficult to remedy. Use what is known as lamp cord and get No. 10 or 12 if possible. The common number is 18.

A fourth trouble is found in the wires becoming unfastened where connected and by touching the frame making a short circuit. The remedy is to discard all forms of wire fastening, screws, twisting, etc., and solder all connections, using rosin and no acid in the process. Place upon the carriage frame a sufficient number of small porcelain insulators, so that the wires when strung upon them shall not touch the metal of the carriage at any point.

To be continued.



MACHINERY and TOOLS ***for*** ***motor vehicle builders***

Readers using information from this department are requested to give credit.

FILES.—1.

By Robert I. Clegg.

There is no tool so common in shop practice and, it may be added, no tool so much abused as the file. Frequently the entire assortment, good, bad and indifferent, are thrown promiscuously together into the drawer allotted to the user; the teeth of a file are so hard that the loss of a tooth from a double cut file is as likely as a slight abrasion of the small cutting points and edges. A good file, suitable in form and cut, of well tempered steel, is not only useful, but has all the potency of encouragement to the mechanic. To the end that the file may have a long and useful existence certain points are worth consideration.

FIRST.—AS TO THE CHOICE OF A FILE.

The cut has to do with the character and spacing of the teeth; the cutting being distinguished as single cut, double cut, and rasp cut; the degree of coarseness being spoken of as rough, coarse, bastard, second cut, smooth, and dead smooth. These terms are arranged from rough to dead smooth in proper gradation of the cutting effect from extreme coarseness to the finest cut possible in everyday manufacture. A file is measured from heel to point only; the tang is the part on which the handle fits; where the tang joins on to the rest of the file is called the heel, and the point is the end opposite to the tang and handle, and, as already indicated, if we speak of a twelve inch file this length is exclusive of the tang entirely.

Very probably the old time custom, when steel and the handwork requisite to making a file were higher priced and files were made sufficiently thick so that when worn they could be recut, has something to do with the lack at present of any fixed proportion between the length, breadth and thickness. Be that as it may, so far as the original cause is concerned, it affords the faddist, who has thereby more chance of gratifying his whims, choice as to minute differences in dimensions and weight. Files are also distinguished by the shape of the cross section as well as the side elevations. The cross sections include the simpler geometrical forms, square, oblong, round and triangular, along with a few odd shapes which are designed for special uses, and outside of these are seldom desired. A file which is reduced gradually in cross-sectional area for, say, one-half to two-thirds its length down to the point, is called taper. If the file, however, preserves its dimensions from one end to the other, it is said to be blunt; bellied is a term indicating a fullness in the centre of the file, and—equaling—indicates a blunt file having a very slight curvature or belly, from point to heel. Square and three cornered files are usually cut

on each side; flat—oblong—files are left with one side uncut, called the safe edge or side, this safe side permitting a portion of an angle or corner to be filed up close without injury to the adjacent parts. A square file desired for similar purposes can have one side ground down. Although one side of a flat file may be uncut, the process of cutting the adjacent sides will force out slight projections at the roots of the teeth which mar the desired smoothness of the safe edge. It is therefore as well before using a file of this kind, where a safe side is imperative, to give the side a rub or two on an emery wheel or grindstone.

SECOND.—FILE HANDLES AND WORK HOLDING DEVICES.

Several patents, the writer understands, have been taken out on schemes for holding files. Possibly one of the best of these was comprised in a nut, contained in the handle, connecting by a split bolt with a pin and hole through the file about half an inch from heel. However, a handle of tough wood which will stand being driven down the whole length of the tang, well equipped with a good brass ferrule, to prevent splitting, made of light material, smoothly finished and neatly formed, is all sufficient for cross-filed work. If the hole in the handle is too small, take an old file, of the same size as the one you desire to insert, heat the tang and burn out the hole to the size for a good driven fit, taking care that the axis of the handle is in line with that of the file. If the handle was not bored out central in the first place, the heated tang is useful to bring the hole in line. The files may be hung, suspended by their handles, from a shelf, or rack, perforated at the edge, and cut through, that the files may be readily hung or taken down; or a broad drawer, with separate compartments or divisions to keep the files from injuring each other, is, in either case, an economical shop feature in saving files.

When a surface is to be filed which is wider than the length of the file, some device must be substituted for the straight tang and wooden handle thereon. Of course, the handle comes in useful if the tang is turned at an angle to the centre line of the file, which would put one side of the file out of service, to say nothing of the makeshift character of such an expedient. Hence the more general custom is a special device, consisting of a metal piece dovetailed or grooved on its underside to fit the tang. This metal piece is of various shapes and often stands at right angles to the file, is shaped like a file tang and carries a handle fitted on in the usual style. A neat and useful design of handle, particularly where it is desirable that the file shall in use be bent slightly convex so as to act upon a smaller area of the work, as well as to get a more lively cut by having fewer teeth acting under the same pressure, is found when the tang and heel carry a dovetailed piece as before and a small thumb plate clips the point and the two are drawn together by a threaded rod, on which the handle is placed almost parallel to the axis of the file. For small files the writer likes a straight handle, longer proportionally than the handles in vogue for larger files; the small files are frequently used in one hand and the straight handle, with index finger resting along the back of the file, gives a good firm grip.

The vise jaws are liable to deface nicely finished work and clamps of some soft metal are used to protect the piece held. Copper, brass and lead are adapted for this purpose. Fibre and cardboard are also useful when the surface of the work held is large enough to distribute the pressure well over the face of the clamps. The vise should be affixed at a height

from the floor that will be suitable for the average user, forty-two inches being recommended as the best distance from the top of the vise jaws to the floor for general work. This is supposed to be level with the elbow of the workman. For very heavy work, where the full weight of the workman may be thrown into action, the distance should be less, while with small and delicate work, requiring movement of the arm and hand, the top of the vise can be brought nearer to the eyes, that the work may be scrutinized easier and the workman stand erect.

For some tasks filing jigs come in very useful, the piece being held in a hardened fixture or a cast-iron frame, in which are set limiting edges of hard steel. Here the file is restrained to act upon a definite place up to prescribed dimensions. These jigs are not common, but occasional work may be found where the amount of material removed is small and can thus be accomplished without appropriating a machine capable of active service elsewhere.

In filing thin pieces a block of hard wood is held in the vise. The pieces are let in or held with brads, which file down with the work. The writer has also held a metal plate in the vise, on which the thin pieces were held with soft solder. Bicycle cement and shellac have been used for such materials as are suitable.

THIRD.—THE MATERIAL FILED.

Cast iron should be thoroughly pickled to loosen the scale, permitting its easy removal with a wire scratch brush; or, if size of piece will allow, rattling. For a reason already given in an article in the "Horseless Age," on boring cylinders for motor vehicles, the pickle should not be applied until the cast iron is cold enough to handle with the naked hand or the sand will burn on hard. The pickle for iron castings is generally sulphuric acid and water, about two of water to one of acid; the pickling fluid for brass and gunmetal castings, a mixture of nitric acid and water, in the proportion of one part of acid to five of water.

The articles are dipped into the bath, where they remain a short time. Thence they are removed and the acid is allowed to act upon the surfaces until the scale is loose, when they are washed with water and cleaned when dry with old files and wire brushes.

A suitable corundum or emery wheel of wide face is excellent in trimming castings at the parting lines, and also comes in useful in grinding away chilled fins and corners, which otherwise would destroy the file. A narrow surface presents a resistance to fewer teeth, and hence a new file is reserved for the broader castings of iron, bronze or brass. And, as the file becomes worn, the more fibrous metals, as wrought iron and steel, as well as the narrower articles of any material. A new keen file will not cut so freely if well rubbed with chalk, and as the interstices between the teeth are partially filled the "filings" or "fins" have less chance to clog the action. When the file has been slightly oiled to cut some fibrous metal or as a preservative against rust, and the file is wanted for filing cast iron, the oil may be removed by chalking the file several times as required and thoroughly brushing. A bit of soft wire, copper or brass, flattened at the end, is good to strike off any little "pin" from the file that otherwise would tear up the filed surface. Card clothing, nailed on a strip of wood, with a suitable projection for a handle, will remove the loose chips very readily.

FOURTH.—USING THE FILE.

Machine work is adopted to such an extent that less filing in the aggregate is to be found than was the custom formerly.

On the other hand, the filing must be of so superior a character that it shall compare with the quality of the parts machined. Hence the work is of a delicate type, a less amount of metal being removed than was formerly the case. Practice being the chief guide to expertness in filing little can be said beyond general suggestion. The less filing on work where accurate truth is required the better, particularly on round work. In lathe work, use a slow, light stroke, moving the file slightly from the right to the left, and vice versa, to avoid grooving, and maintain the even surface left by the tool. When filing close to lathe dog or chuck do not make too long a stroke, as the point of the file is apt to catch. If the file handle is then held in the left hand there is not only less danger of that accident, but the sleeves are out of the way. A connecting rod is often drawfiled (in the direction of its length) and then near the ends is polished while rotating in the lathe. The contrasting effect is pleasing but otherwise useless. Piston rods are frequently drawfiled with the idea of having a more even and uniform surface, and thus save both in friction and trouble at the stuffing box. Some work formerly finished by file in the lathe is now done with greater accuracy and dispatch on the grinder, which will be considered later. In filing concave surfaces the idea suggested in maintaining truth of lathe work is equally good; namely, moving the path of the file from side to side.

FIFTH.—FILE MANUFACTURE

The blanks intended for files are forged, carefully annealed (not to exceed a red heat), and ground to shape. After the surfaces are perfectly smooth and clean they are lightly greased and are ready for cutting. The old time hand cutter took the file on an anvil, with the tang turned toward him. A leather strap, one end of which is held fast by each foot, keeps the blank steady on the block or anvil. The cutter uses a chisel to cut the ridges of the file, beginning at the point. When cutting the other side a thin plate of soft metal is placed between the anvil and the file blank. To preserve the teeth from the action of the fire when being heated, the file is passed through beer grounds or some sticky matter, and then through a mixture of salt and hoofs, roasted and ground. The modern system of manufacturing has taken the old hand process and its irregularity of cut has been copied and again produced by automatic machinery.

In an "increment cut" file the spacing, as well as the angle between each cut, is capable of a slight variation accomplished on the machine, which reproduces the good qualities of the hand made file at a rapidity out of all comparison.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

LONDON NOTES.

(From Our Own Correspondent.)

London, July 26.

There can be no doubt that the two recent motor exhibitions here have done much to advance the movement in this country, and it is not too much to expect that the same will be the result of the exhibition which is to be held in the German capital in September next under the auspices of the Mid-European Motor Car Club. In fact, the applications for space have come in so rapidly and in such numbers as to greatly exceed the area originally provided for, the result being that the authorities have decided to erect two large temporary buildings, one of which will be devoted to a demonstrating track.

MR. WHITNEY THE STAR ATTRACTION.

Mr. Whitney, of Boston, Mass., with his steam carriage, is quite the hero of the hour. After reaching the exhibition at the Agricultural Hall, London, he was the man most in request, and if he took one person for a trial run round the



WHITNEY WITH HIS STEAM CAR AT HENLEY-ON-THAMES, ENGLAND, JULY 16, 1899.

demonstrating arena during the subsequent four days, he must have taken two or three hundred. He is next bound for France, there to show his machine. He expects to get back to his native heath about the end of September.

MOTOR VEHICLES FOR COMMERCIAL PURPOSES.

The commercial possibilities of motor vehicles is beginning to be recognized in England. Although the adoption of horseless carriages by the wealthy classes is at present keeping all existing manufacturers fully occupied, there is always the danger that this may be a passing fashion, so that the stability of the new movement lies more in the adoption of motor vehicles for industrial purposes. The announcement made by the Daimler Motor Co. this week is therefore of special interest. It is to the effect that they have been commissioned to build for W. F. Locke-King, the proprietor of a number of farms in the neighborhood of Weybridge, Surrey, no less than three large motor vans to be fitted with gasoline motors of 12 h.p. The vehicles are intended for the transport of farm produce from Weybridge to the London market. Hitherto these deliveries have been made daily all the year round by rail. As a result of careful inquiries, I understand that Mr.

Locke-King is more than satisfied that even after allowing a large percentage for repairs and depreciation, there will be a considerable margin in favor of the transport by the motor vans. Not only so, but a saving of at least four hours a day will be effected, and seeing that the deliveries take place every day in the year, this saving, taking the twelve months, will be no inconsiderable item in itself. The enterprise shown by this Surrey farmer should set the owners of large farms in the United States thinking, for if motor vehicle transport can be proved to be more economical than rail transport in England there is no reason why the same should not be true in America.

TWO MOTOR SHOWS NEXT SPRING.

The question as to whether there should be two annual motor vehicle exhibitions in London is just now the subject of much discussion in motor circles here. It would occupy too much space to detail the reasons which have led up to two shows being held recently, but the plain fact is that the last one—that held at the Agricultural Hall under the auspices of the Motor Car Journal—was the first to be announced early last year, the holding of the Richmond show by the Automobile Club a fortnight before having been a subsequent decision. After a chat with the representatives of several firms which exhibited at both shows, I am able to say that the Islington show was the best from a business point of view, the Richmond show, notwithstanding its official organization, having proved less successful, as the guarantors were called upon to make good an amount which has not been made public. A few weeks ago the Motor Car Journal announced that its 1900 exhibition would be held in the same locale—the Agricultural Hall—from April 14 to April 21. This week a meeting of the Automobile Club was held, when it was decided to organize an exhibition to be held at the Crystal Palace, from March 24 to April 7, 1900.

INCREASE IN THE SPEED LIMIT.

English builders of heavy motor vehicles have this week received the welcome information that there is an early possibility of the relatively low legal speed limit permitted to wagons of this class being increased. Representations have from time to time been made to the local government board urging an increase in the speed limits of heavy motor vehicles weighing, unladen, over $1\frac{1}{2}$ tons, and it is now announced that at the request of the board the Automobile Club of Great Britain is about to undertake experiments for the information of the inspectors of the board as to the stopping power of such vehicles on level roads and on hills. The trials are to be held near Richmond, Surrey, on Friday, Aug. 11. Speaking at a dinner in honor of Baron de Zuylen, president of the French Automobile Club, on Monday last, General Carey, chief engineer to the local government board, stated that if the trials in question proved satisfactory he had no doubt that in the long run such concessions would be made as might in the opinion of the board be compatible with the safety of the public.

Marshall & Co., of Belsurge Works, Clayton, Manchester, who have for some time been building gasoline motor vehicles of the type known as the "Hurtu," are now arranging to take up the manufacture of motor tricycles. They have acquired the rights in a new French machine known as the Renaux, the feature of which is the employment of a horizontal gasoline motor of $\frac{3}{4}$ h.p. The Renaux tricycle is a speedy machine, as the other day at one of the velodromes in Paris M. Renaux rode a distance of no less than $38\frac{1}{2}$ miles in one hour, on one of his machines.

INCREASING THE HORSE POWER.

The announcement made last week that De Dion, Bouton & Co., of Puteaux, Paris, had decided to substitute a $2\frac{3}{4}$ -h.p. motor for the $1\frac{3}{4}$ -h.p. type which has hitherto prevailed, has caused quite a flutter of excitement in motor tricycle circles here. Already the Beeston Motor Co., Ltd., of Coventry, announce that they are arranging to manufacture $2\frac{3}{4}$ -h.p. motors, while a similar step is contemplated by the Motor Mfg. Co., Ltd., of Coventry, which has lately taken up the construction of motors of the De Dion type in England.

LONDON ELECTRIC CABS WITHDRAWN.

The evening papers to-day furnish a sensational motor item to the effect that the electric cabs of the London Electrical Cab Co., Ltd., have been withdrawn and the company's station in Lambeth closed. The reason assigned is the difficulty of obtaining drivers for the vehicles, and also the exhaustion of the company's capital. From what is rumored, however, there is every probability of the company being reconstructed at an early date.

THE GEERING KEROSENE VEHICLE.

Quite a number of firms in England are still endeavoring to produce a successful motor vehicle propelled by means of a motor using kerosene instead of gasoline. The latest firm to produce a carriage of this kind is T. Geering & Son, Regent St., Rowenden, Kent. The carriage, which is arranged to accommodate three persons, is provided with a two-cylinder motor having water jackets and tube ignition. The cylinders are each 4 in. in diameter by 5 in. stroke, and work up to 3 h.p. The motor is located on the rear portion of the vehicle, the power being transmitted to a countershaft by pinions and from thence to the rear wheels by sprocket wheels and chains. Three forward speeds—4, 8 and 12 miles per hour



THE GEERING KEROSENE CARRIAGE.

—and one backward motion—4 miles—are provided, the speed variation being controlled by a single lever. By a friction clutch controlled by a foot pedal the motor can be cut out from the transmission gear, the starting and stopping of the vehicle in traffic being in this way controlled. The motor and transmission gear are all carried on a standard frame, built of channel-section steel, to which any type of carriage body can be fitted. The wheels have wooden spokes and solid

rubber tires, shoe brakes controlled by screw gear acting on the rear tires. The weight of the carriage complete is stated to be about 1,000 lbs.

EXTENSION OF PUBLIC MOTOR SERVICE.

The extension of public motor service in England is progressing at a satisfactory rate. Only a month or two ago a Daniels motor wagonette was started between Herne Bay and Canterbury in Kent, and so satisfactory has it proved that the organizers have just increased the service by placing a large "Life" steam wagonette on the route. The first run of the new vehicle, which cost over \$3,000, took place yesterday, the passengers on this occasion comprising a number of the local authorities. A "Life" steam omnibus has also just been put in service between St. Margarets and Dover, Kent, while at Lowestoft a company has just been registered to run a service of horseless vehicles in that district.

A company has just been formed in Milan, Italy, with the title La Societa Italiana di Vetture Elettriche Turinelli & Co., to introduce electric vehicles on a large scale under the patents of Pezza & Turinelli, recently referred to in these columns.

Report also comes of still another Italian motor vehicle company, the Fabbrica Italiana di Automobili, registered at Turin, with a capital stock of \$160,000. The company intends to erect large works in Turin for the construction of motor vehicles, but of what type is not stated.

Schuckert & Co., of Nuremberg, one of the largest electrical engineering concerns in Germany, have taken up the manufacture of electric motors suitable for electric vehicles. One of their first productions is a 2 h.p. motor weighing only 107 lbs., and running at a normal speed of 1,500 revolutions.

A new gasoline motor is about to be put on the market by Hurst & Lloyd, engineers, 257 High Holborn, London. It is to be made in sizes ranging from 2 up to 6 h.p.

OUR FOREIGN EXCHANGES.

A Light French Motor Bicycle.

La Locomotion Automobile gives a detailed account of a motor tricycle invented by Lamandiere & Labre, 41 rue du Bois, Levallois-Perret (Seine), France.

The gasoline motor is placed along the central tube of the frame. This tube, a, (Fig. 2 or 3) has at its end a flange b, braced round it and pierced with four holes. The centre of gravity is low.

The Otto cycle motor makes 2,000 revolutions, is said to develop $1\frac{1}{2}$ h.p. and weighs only 18 lbs., fly-wheel included.

The inlet valve p, and the seat q, (Fig. 3) are screwed together in the upper part of the case, and have a union screw joint which receives the admission tube r, from the carburetter.

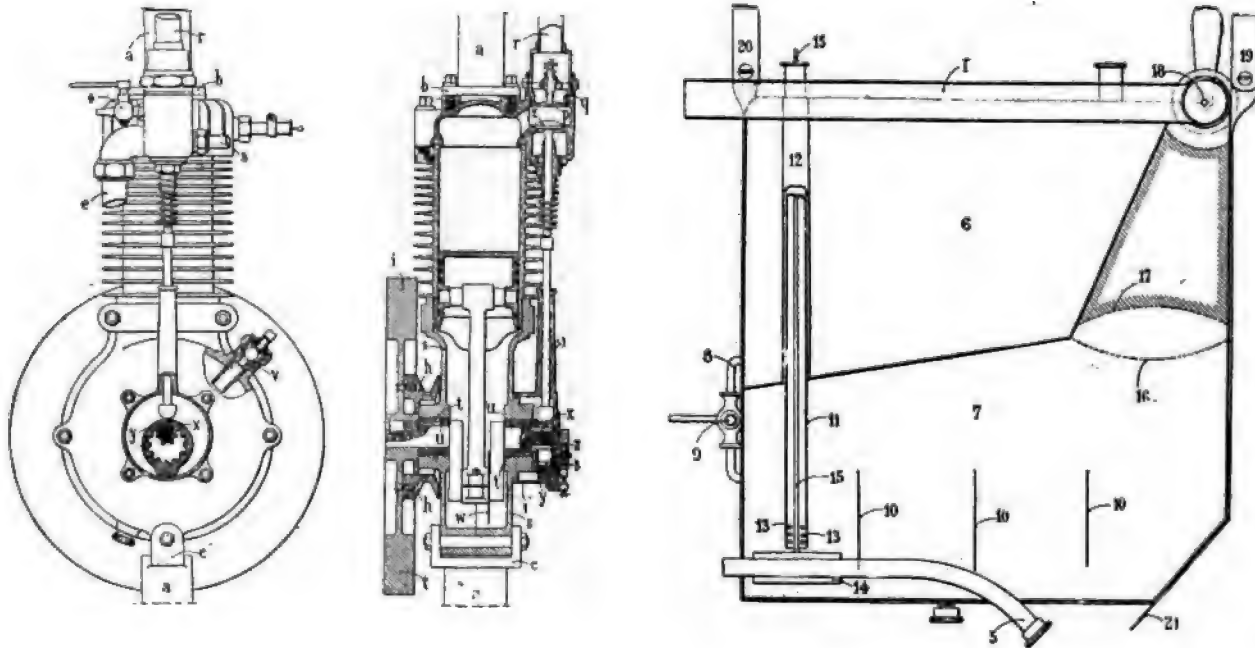
The cranks are enclosed in a case of composition metal s, which passes over the motor axis and rests on free bearings of bronze u and fixed steel bearings t. A side valve v (Fig. 2), in case of internal compression, allows vent for the excess of air in the crank chamber preventing the oil from leaking through the bearings.

Lubrication is automatic, secured by means of a movable washer *w* idle on the head of the connecting rod which, at each turn, dashes into the oil and throws it up to the cylinder.

The right end of the motor shaft (Fig. 3) is cut in the form of a gear, operating interiorly the cam *x* of the exhaust

a pulley *h*, transmitting the power to the rear wheel. A compression valve (Fig. 2) is found at 4, and 5 is a tube conducting part of the exhaust gases into the carburetter *m*. Under the pedals (Fig. 5) is the muffler.

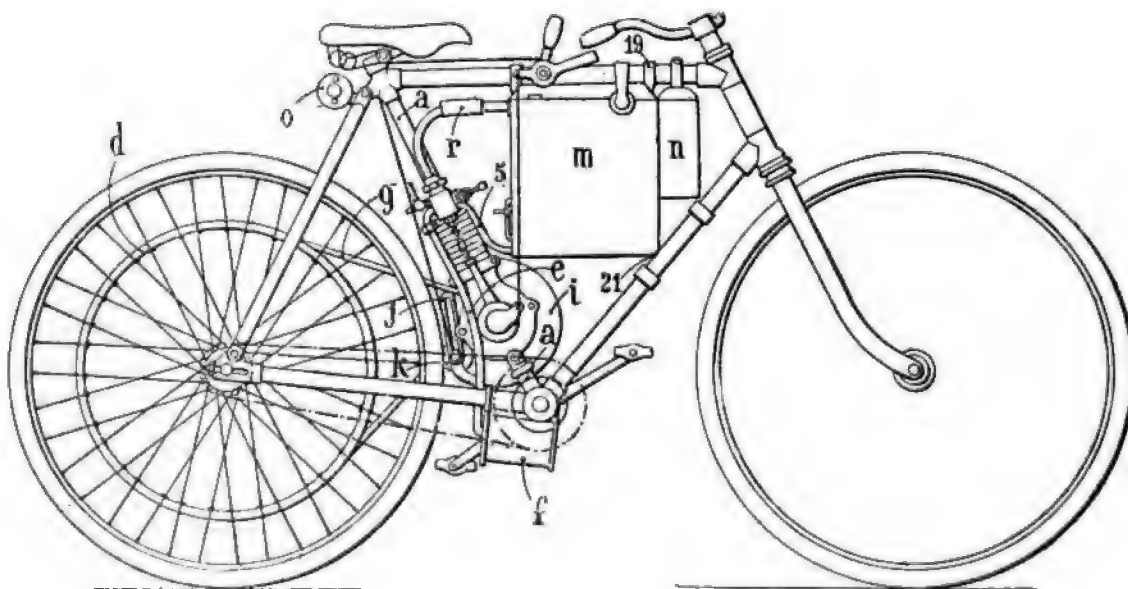
The ignition, which is electric, is produced by a contact spark without a vibrator. The storage battery *n* furnishing



valve *z* (Fig. 2). A covering *I* protects this mechanism and is prolonged to form the guide rod of the exhaust valve *z*. The cam *y* has a prolongation 2 on which is fixed the ignition cam 3.

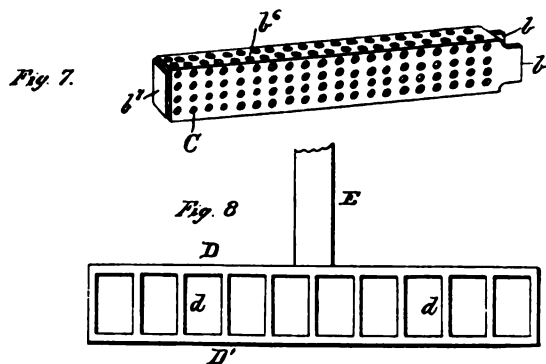
At the left end of the motor shaft the fly wheel *i* carries

the current, gives two volts and requires recharging every 350 miles. The induction coil *O*, placed under the saddle, weighs only 800 grammes. The weight of the machine is 65 lbs.



MOTOR BICYCLE OF LAMANDIERE & LABRE.

active material are relatively shallow, as are also the several bodies of the electrolyte liquid. The specific gravity of the latter therefore is substantially the same throughout. The electrolyte has ready access to and circulates through the mass of active material in the arms B B'. The perforated walls of these arms not only serve as a retaining-envelop for the active material, but also constitute a large factor in the electric efficiency of the cell, inasmuch as, unlike the



perforated lead envelops heretofore employed, they are preliminarily rendered highly active by suitable treatment prior to being charged with the granular or other supplemental active material.

The cells may be electrically connected together in any desired way, either in series or in parallel.

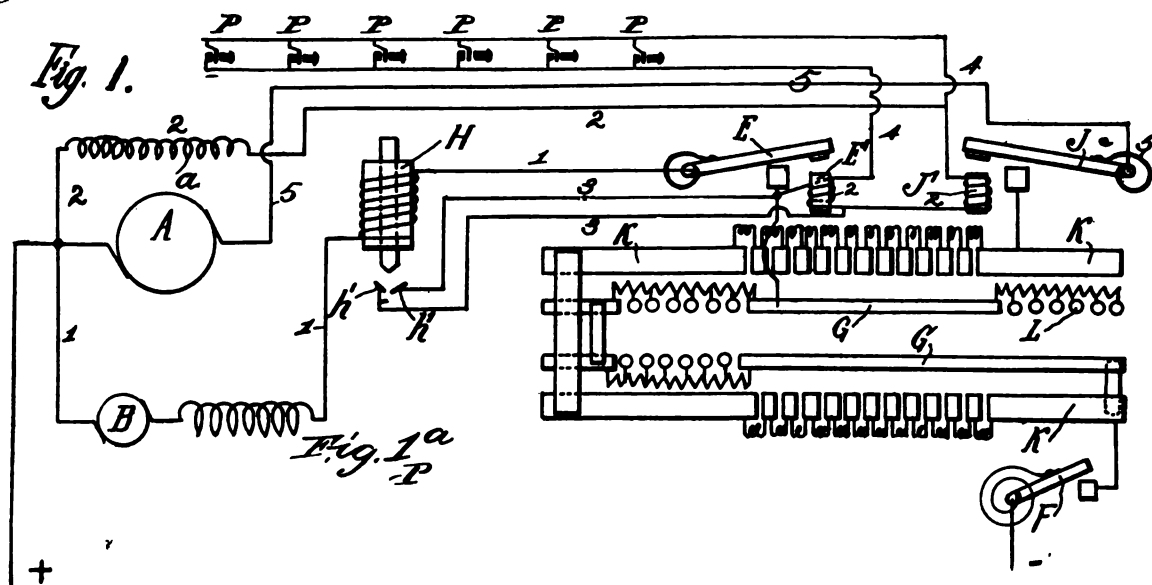
No. 629952, Dated Aug. 1, 1899—Means for Driving Machines at Variable Speeds by Electric Motors.—Walter Angove Clatworthy, of Newcastle-upon-Tyne, England, Assignor of One-Half to J. H. Holmes & Co., of Same Place.

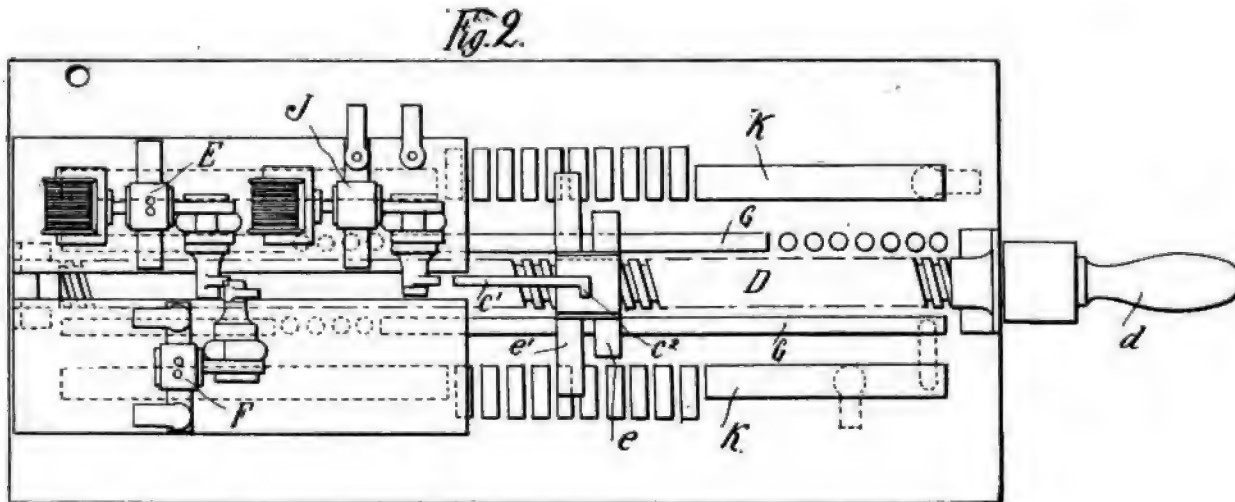
C is a double contact sliding switch serving mechanically to close the contacts or switches E, F, and J in the order named when traveling from left to right, E being the contact switch to effect excitation of the small auxiliary motor and by a solenoid H to throw in the clutch h, Figs. 7 and 8, between

the auxiliary motor B and the shaft of the main motor A. F is the main switch or contact for the main current, and J is the switch or contact for the main motor A, the field of this latter being excited, preferably, by a shut current, as shown at a, Fig. 1.

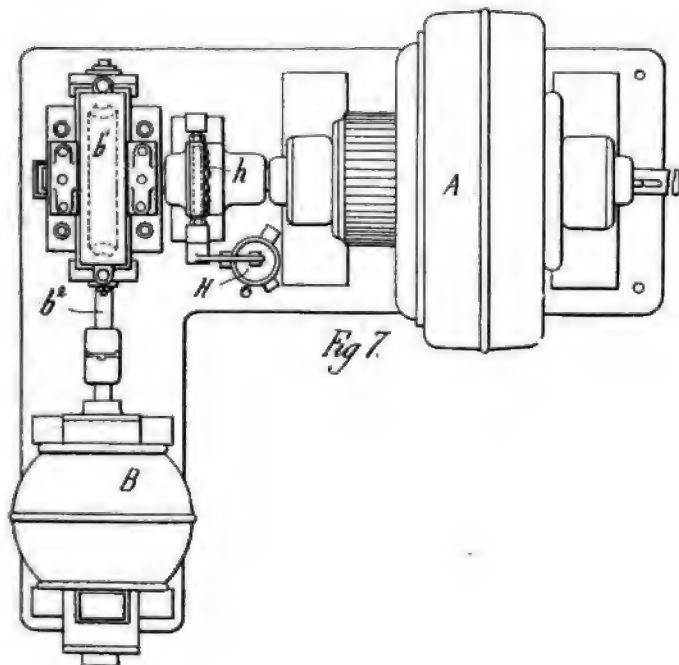
P P are push buttons serving to short-circuit the electro-magnets of the electrically held switches E J.

The construction of the combined sliding switch C is as follows: The sliding double contact block or cross head c is mounted upon a screwed shaft D, turned by a handle or wheel d. The cross head c carries two bridge contacts e e', Fig. 6, bridging between the two sets of parallel contacts G G and K K, the former for the smaller motor and the latter for the large motor, the said contacts being divided in parts with intermediate resistances to control the current as to its gradual effects upon the motors. The cross head c has a projecting nose c', adapted to engage under tappets on the spindle of the switch contacts E and J, and a right-angled projection c'', operating the tappet of the switch F. The nose c' is considerably elongated away from the direction of the travel of the cross head c to maintain mechanically for a short time the closure of the switch contacts E and J, as these switch levers are so heavily spring pressed by a coil spring f' about these pivots that their contact levers will at once rise to a definite normal position, in which the tappets or the switch axes depend vertically, by the action of such recoil spring unless held by the nose c' or by the electromagnets E' and J'. In the case of the contact switch F this is so lightly spring pressed that it will not automatically recoil from the jamming contact piece and is not therefore electrically held, and in this case the pivot of the lever has a double forked tappet f f', as shown in Fig. 5, so that the switch lever is closed by the travel of the cross head c catching one arm of the forked tappet by the narrow right-angled piece c'' of the nose c' in one direction and is opened by the return travel of the cross head c catching the other arm of the tappets f f'. In the case of the other switches when released from their electrical retention the tappets are always in a downward vertical direction when the controlling springs are at normal and are always therefore in a





position to meet the nose of the sliding cross head *c*. Upon return of the cross head *c* to position on the left the said tappets are merely lifted against the spring reaction and return to normal vertical downward position ready for the return action of the cross head from left to right to close the switches again.



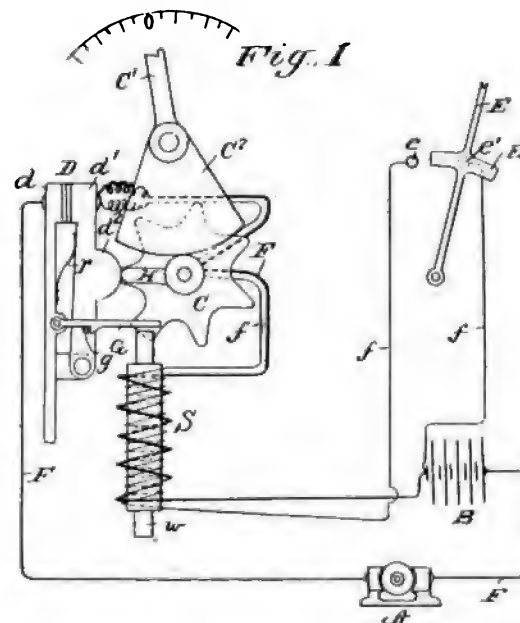
The arrangement of the two motors is as follows: The main motor *A* has its shaft directly connected to the first motion shaft of the driven machine, such as a newspaper printing machine. The auxiliary motor *B*, with its shaft at right angles to that of the main motor, gears with a continuation of that shaft by a worm and worm wheel *b b¹*. The small motor may thus run at its best and highest speed while only rotating the main shaft at a slow speed, as is required.

The worm wheel shaft of the auxiliary motor is connected to the main shaft of the machine by a sliding saw-toothed clutch *h*, operated by a lever and solenoid *H*. The ascent of the solenoid core throws the clutch into gear,

No. 629837, Dated Aug. 1, 1899—Motor Control.—Allan H. Whiting, of New York, N. Y., Assignor to Andrew L. Riker, of Same Place.

A indicates an electric motor, and *B* a source of electricity, as a battery, for supplying power thereto.

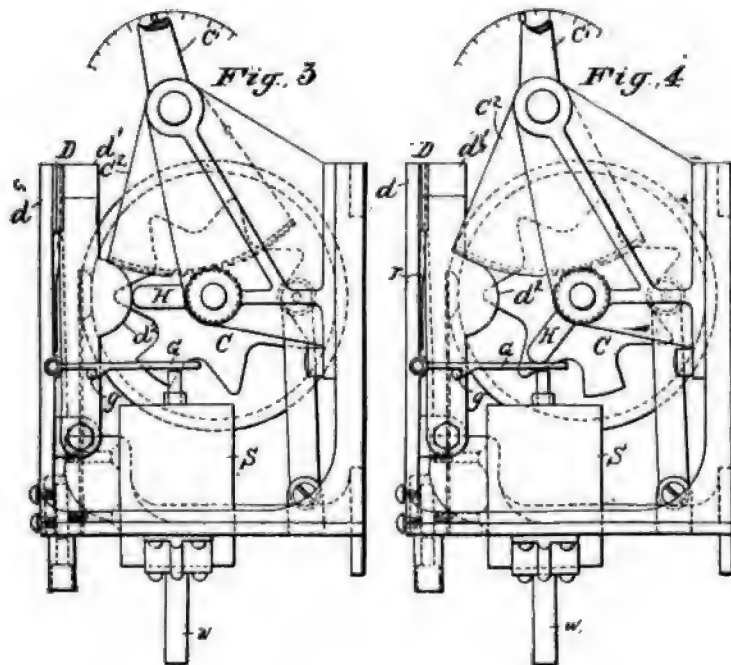
C is a controller regulating the supply of current to the motor, *C'* the controller lever, and *D* is a switch in the circuit *F*, said switch having the stationary jaw or member *d* and the pivoted or otherwise movable member *d'*. The switch is held closed against the tension of the spring *r* by the latch *G* engaging the latch pin *g* on the pivoted member *d'*.



S is a solenoid, the heavy wire of the main circuit *F* making a limited number of turns around the core *w* thereof and thence to the battery *B*. The course of this main circuit is from the battery *B*, the motor *A*, the switch *D*, the controller *C*, and around the solenoid *S* to the battery.

Connected to the movable member *d'* of the switch *D* is a fine wire *f*, which passes with a large number of coils around the solenoid core *w*, and thence to a contact point *e* and from a second contact *e'* to the battery.

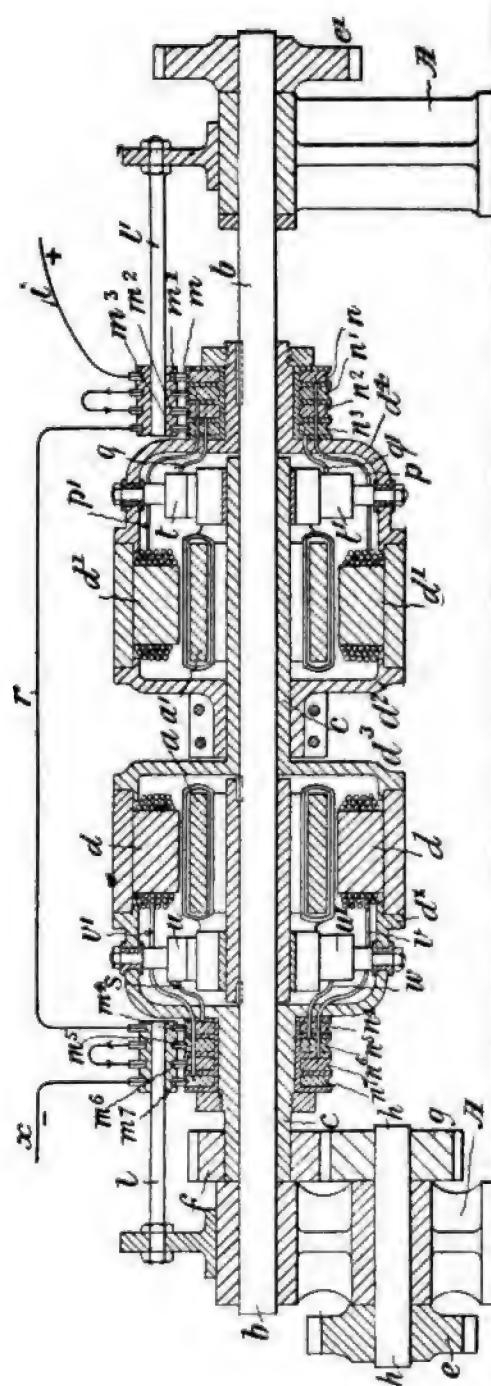
E is a pivoted brake lever having connected thereto, but insulated therefrom, a metallic contact plate E', wiping across the two contact points e e' when the brake lever is in position to apply a brake (see Fig. 2), but normally occupying a position in contact with but one of said points, as shown in Fig. 1.



H is a lug or arm on the controller C, and d² is a cam projection on the movable part d' of the switch D, the relative positions and proportions of the arm and cam being such that the arm H by impinging on the cam d² when the controller is rotated closes the switch against the spring r and permits the catch G to drop over the latch pin g.

No. 629872, Dated Aug. 1, 1899—Electric Motor.—James Thomas Robson, of London, England, Assignor of Two-Thirds to Charles Henry Marsden and Henry William Headland, of Same Place.

The motor is operatively mounted in a framing A. In this framing is supported the shaft b. The armature a of one motor is fixed on the shaft b, which passes through a hollow shaft or sleeve c, upon which the armature a' of the other motor is keyed, and the field magnet casing d² d' around the said armature a' is also keyed to the shaft b. Upon the end of the shaft b is shown, as an example, a sprocket wheel e' for transmitting the power, and upon the outer end of the sleeve c or hollow shaft is shown a spur wheel f, which gears with a spur wheel g upon another shaft h, journaled in the framing A. A second sprocket wheel e, secured to the shaft h, serves for transmitting the power. Both of these sprocket wheels e and e' will thus be rotated in the same direction. The part d' of the casing is made in halves bolted together. The casing for the motors d² d' and d² d' may be made of open work or may be closed dust-proof. For driving by spur wheel gearing instead of by sprocket wheels and chains I may fit a spur wheel on one end of the shaft and another spur wheel on a sleeve at the other end, one such wheel to gear with an outside spur wheel and the other with an inside spur wheel. The current may be supplied in the manner indicated.



The wire i leads from the battery to the outer end of one motor and the wire x from the outer end of the other motor back to the battery. On studs l and l', suitably fastened to the framing A, are carried four brushes, m m' m² m³ and m⁴ m⁵ m⁶ m⁷, which engage with rings n n' n² n³ and n⁴ n⁵ n⁶ n⁷, that rotate with the motors. These brushes are insulated from the studs and from each other. Other brushes u and t and u' and t' are fixed to but insulated from the interior of the field magnet casing d² and d' and connected by insulated wires to the various parts. The current thus runs from battery wire i to brush m, collecting ring n, wire p, field magnets d',

wire p', ring n', brush m', brush m', ring n', wire q, brush t, armature a', brush t', wire q', ring n', brush m', wire r, brush m', ring n', wire s, brush u, armature a, brush u', wire w, ring n', brush m', brush m', ring n', wire v field magnets d, wire v', ring n', brush m', and wire x to battery.

The two motors are connected in series; but by changing the connecting wires to the brushes of the collecting rings two armatures may be put in series and two fields in parallel or the two armatures in parallel and the two fields in series, and the sequence of connections to armature and field magnets may be either field magnet, armature, field magnet, and armature, or field magnet armature, armature, and field magnet. By the means described I am enabled to reverse the current and the rotary motion of the motor. By the arrangement described the rotating parts may be made to balance their centrifugal forces at all speeds.

For driving two propellers (right and left hand) in opposite directions in the same axis without employing wheel gearing, I omit the wheels e', f, g, and e and fit one propeller on the prolonged end of the shaft b and the other propeller on the prolongation of the sleeve c.

No. 630271, Dated Aug. 1, 1899—Emergency Brake for Cars or Vehicles.—George E. Stanley, of Whitman, Mass., Assignor of One-Half to John E. Miles, of Boston, Mass.

The car may be of any usual or desired construction, it being herein typified in the platform A, supported upon suitable or usual wheels a, which may be rigid on the body or arranged in usual swivel trucks, as desired.

The usual dasher is indicated at b.

The brake proper, which may be of any desired form, is here shown as comprising the brake shoes c c, carried by the brake hangers c', said shoes being connected with and moved toward and from the wheels in usual manner by the levers

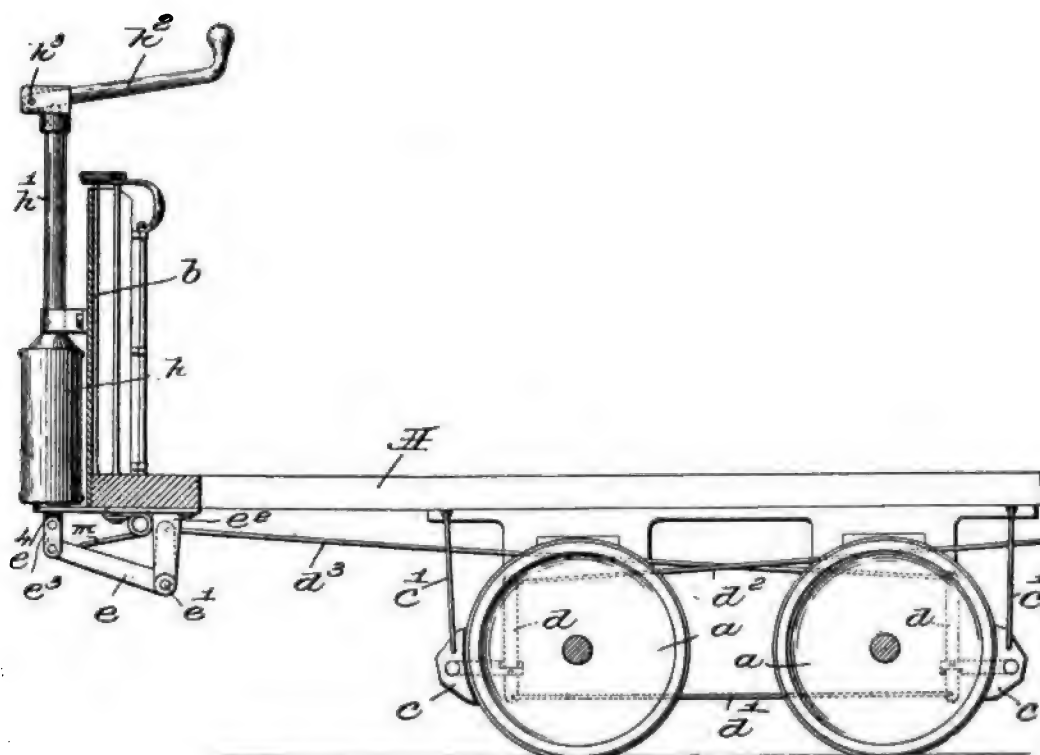
d d and rods d', d', and d'. The rod d', through which the brakes, as shown, are actuated, is shown as connected at its outer end with one arm of a bell crank lever e, pivoted at e' in a bracket c', depending from the car platform. The other arm of the bell crank lever e is shown as connected by a link e' with the lower end of a vertical rod e', threaded at its upper end and hereinafter referred to as the "screw." This screw e' is received within the sleeve f, the sleeve being freely movable on and with reference to the screw.

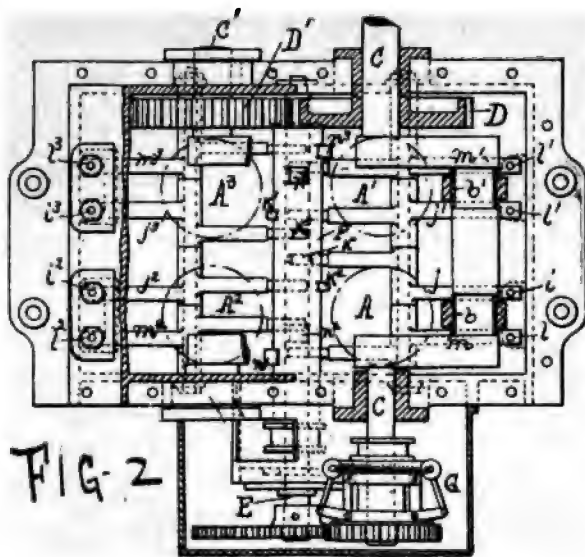
Within the sleeve f and shown as formed integrally therewith are the oppositely arranged cones f' f', arranged to act upon and separate alternately the opposite ends of two levers g g, fulcrumed upon pivots g', which pass through slots f'x in the sleeve f and are supported at their ends in and by the outer casing or cylinder h. These two levers g g are threaded at their upper ends to embrace and engage the threads on the screw e', the said levers being made to open away from the screw and to close into engagement with the screw, according as their upper ends are separated by depression of the sleeve f and cone f' or their lower ends separated by the raising of the sleeve f and cone f'. These two levers thus constitute, in effect, one form of separable or multipart nut.

The casing h, which receives and contains the vertically movable sleeve f, has an upwardly extended tubular neck or stem h', secured to the dasher, but in such manner that it, with its contained sleeve and separable nut, may be rotated in either direction. For this purpose the upper end of the tubular neck h is provided with a suitable brake-controlling member.

For emergency applications I have provided the following as a convenient mechanism:

The brake handle h' is horizontally pivoted at h' in the neck h' of the casing, so that said handle may be raised and lowered, it being normally sustained in elevated position by





on the aforesaid sleeve F, connected to the governor, as above stated. The rods $l' l' l' l'$ of the discharge or exhaust valves rest upon levers $m' m' m' m'$, bearing upon cams $n' n' n' n'$.

The governor is keyed upon the shaft C and transmits end movement to the cam sleeve F by the aid of a small lever p, engaging at one extremity with the slide of the governor and at the other with that of the sleeve F. The shaft of this sleeve carries a toothed wheel q, driven by another, q' , fixed to the governor and of about half the diameter of the former.

BRITISH PATENTS.

No. 11763, Dated Aug. 1, 1899—Explosion Engine or Motor.—Frederick Richard Simms, of London, England.

A is the explosion engine or motor, a the cylinder, and b the exhaust thereof.

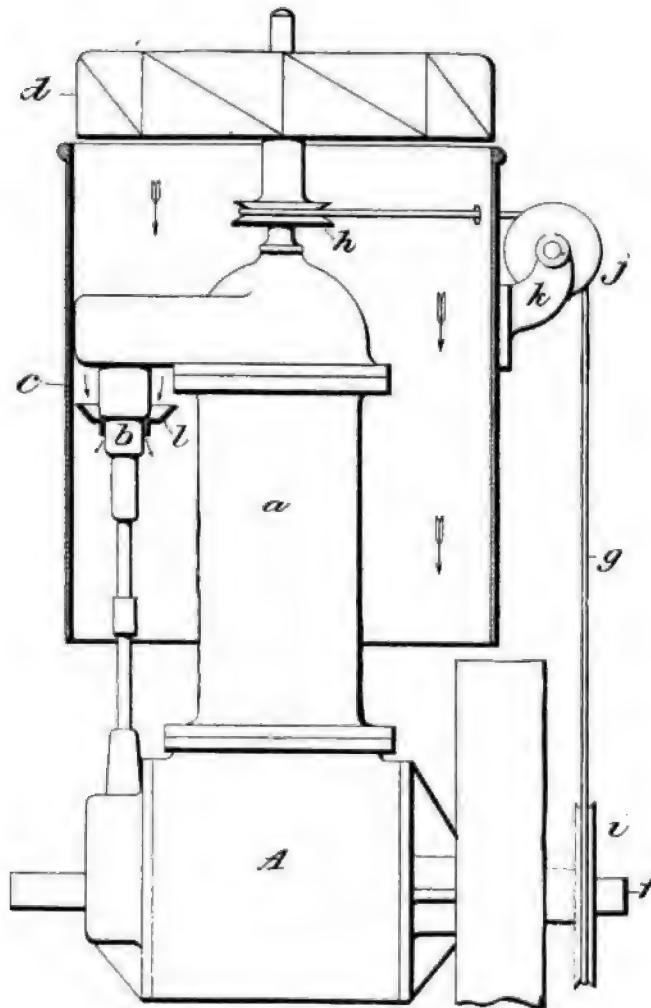
c is an outer sheet-metal jacket or casing inclosing the cylinder a and exhaust b, the said jacket or casing having for its object to direct the cooling current of air.

d is the fan, mounted upon a spindle e, arranged at the outer end of the cylinder a, the said fan being rotated from the crank shaft f of the engine by means of a belt or cord, g, which passes over pulleys h and i upon the spindle e and crank shaft f, respectively.

j is one of a pair of guide pulleys for the belt g, the said pulleys being carried in a bracket k, fixed to the jacket c.

l is a jacket arranged around the exhaust passage b, the said jacket being formed flaring at its upper end and having for its object to cause a current of air to flow along and in contact with the said exhaust passage.

With this construction when the engine is running the fan, which is keyed upon the spindle e, is rotated and drives a current of air in the direction of the arrows inside the jacket c and into contact with the walls of the cylinder a of the engine, so as to efficiently cool it, the flaring jacket l also directing air against the walls of the exhaust passage b, as above mentioned.



AUSTRALIAN PATENTS.

From Phillips, Ormonde & Co., Patent and Trade Mark Agents, 533 Collins St., Melbourne, Victoria, the following particulars have been received of motor vehicle patent applications in Australasia. Should any further details be required we are authorized to state that Messrs. Phillips, Ormonde & Co. are in possession of all the information that may be wanted.

Motor Driving and Controlling Gear for Motor Cabs.—H. Thompson, of 869 High St., Armadale, Victoria. June 3, 1899. No. 16237. In the Colony of Victoria.

Mechanism for Utilizing the Bumping of Vehicles for Assisting in the Propulsion of Same.—G. B. H. Austin, of 60 Armadale Rd., Armadale, Victoria. June 6, 1899. No. 16243. In the Colony of Victoria.

Vaporizers and Pumping and Governing Mechanism of Petroleum Engines.—C. Robinson, of Oban St., Hawksburn, Victoria. June 12, 1899. No. 16265. In the Colony of Victoria.

Gas or Internal Combustion Motive Engines.—W. L. Corson, of San Francisco, United States of America. May 12, 1899. No. 11627. In the Colony of New Zealand.

An Auto-Motor Jinker, Principally for Conveying Heavy Logs.—H. C. Stephen, of Torbay, Western Australia. May 12, 1899. No. 2518. In the Colony of Western Australia.

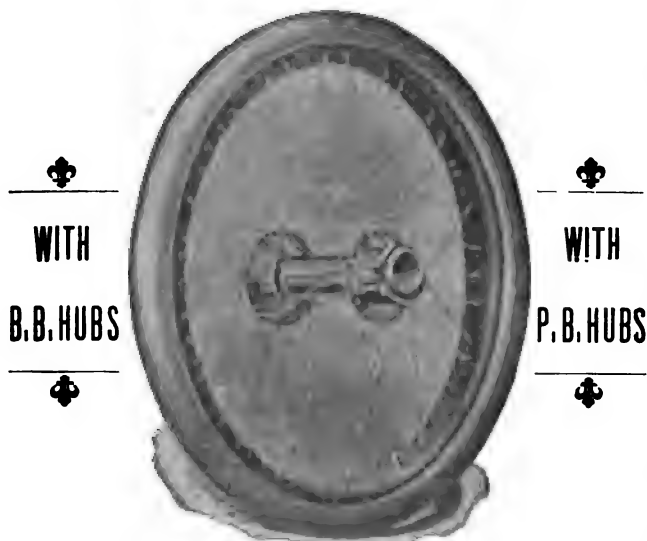
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VOLUME 4

AUGUST 23, 1899

NUMBER 21

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the
Motor Vehicle Industry.

ESTABLISHED 1895.

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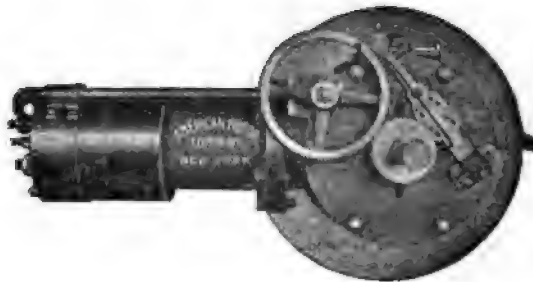
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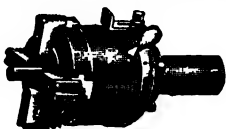
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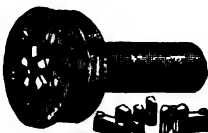
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THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS

VOL. IV.

NEW YORK, AUGUST 23, 1899.

No. 21.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:

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**On account of the excessive discounts charged
by New York banks on small checks under their
new rule, subscribers are requested to remit by
Post Office or Express money order or N. Y. draft.**

Incompetent Motormen.

Even in France, where there are several schools for the training of motormen and chauffeurs, loud complaints are heard of the incompetence of many of the persons who style themselves mechanicians and secure positions as drivers of private or public vehicles. Several accidents of recent date have been ascribed to this cause, and employers are urged by the foreign journals to look well to the qualifications of those whom they engage to take charge of their vehicles.

In the rush and excitement of a new sport the temptation to slight the drudgery of familiarizing one's self with the management of a machine is strong, and in their eagerness to reel off rapid miles automobilists who engage drivers will not examine into their credentials with sufficient care, and accidents will result.

Timely warning may cause a closer attention to the qualifications of motormen.

Agricultural Motor Wagons.

The agricultural phases of the motor vehicle are beginning to be appreciated here. The cotton fields of the South are just now a center of interest on this account, several large owners having decided to investigate the new vehicle, with the object of introducing steam wagons for the transportation of the cotton crop from the field to the market. The distance to market in the cotton districts is generally considerable and the nearest railroad often 20 or 30 miles away. In the North, where railroad freights are cheaper, the wagon could not compete with the railroad for so long a haul, but it is possible that in the outlying cotton districts the cost of carrying the crop from the field to the rail and of rehandling at the terminus may be so great that direct transportation by road would be cheaper for a time, at least. As the country develops, however, and railroad facilities improve, the competition of the railroads would limit the motor wagon to a short haul in populous districts.

"Sport" The Moloch in France.

The sportsmen of France had better make the most of their racing holiday on the public roads, for it will not last long. Nor does it deserve to. They are endangering the lives of the people every day by the hurricane speeds which they indulge in upon the highways, and the evil is becoming so rampant that the authorities will soon be compelled to interfere and banish them to the racing tracks, where they belong. Sport and the world's business will not harmonize. They must be separated and the sportsmen compelled to gather with their own ilk on private grounds, where they may break their records and their necks to their hearts' content.

They have no right to jeopardize the lives of the community.

Horse and Driver Alike.

Elwood Haynes, of the Haynes - Apperson Co., Kokomo, Ind., who recently made the long run from Kokomo to New York in one of their carriages, says he believes the average horse is afraid of a motor carriage, not because of the noise it makes, but because it moves along without the aid of animal power, and, therefore, has about it something uncanny to the equine mind. Other users who have carefully observed the conduct of horses in meeting motor vehicles on the road are of the same opinion, and as a like bewilderment and terror may be observed in many of the human beings who drive horses, the mental processes of the horse and the man appear to be quite similar after all.

The Roaring Lion.

The lion's roar of the monopolists who early in the year were seeking whole motor industries to devour has dwindled to a bird-like chirp, just loud enough to remind us of their existence and altogether peaceful and domestic in its tone. We are glad to have the monopolists with us. The motor vehicle industry is big enough to accommodate any number of monopolists, as well as independents of all kinds and degrees, and when the lion has lost his roar and his claws he is forced to content himself with a more abstemious diet.

Liverpool Heavy Motor Trials.

The progress made abroad during the past year in the construction of heavy wagons for the transportation of merchandise is most gratifying to all believers in this branch of the industry. The heavy motor trials at Liverpool passed off this year without a hitch, whereas a year ago breakdowns were of discouraging frequency, particularly in the wheels. It was the little things that required attention—details of adaptation which only experience could bring to light. That last year's participants profited by their experience the unqualified success of the recent trials amply proves.

The progress of the motor vehicle movement is from the outset and all along a lesson in perseverance.

Dead Letter Laws.

As predicted by the editor of The Horseless Age, the park authorities who have been so injudicious as to exclude motor vehicles from their confines are offering but a feeble resistance to violators of their ordinances. Having stirred up a perfect hornets' nest of criticism from all sides, they are quite content to save their official dignity by letting the matter drop as quickly as it will. They had not counted on the popularity of the motor vehicle, and to public opinion must all public servants bow.

Idle Questions.

Many of the questions propounded for our query department could be spared if our correspondents would read carefully The Horseless Age and other technical journals devoted to the motor vehicle industry. Nearly all the problems connected with this new subject have been from time to time treated by our different writers in various aspects, so that one who follows the journal closely will obtain a very correct idea of the present state of the art, both here and abroad. But those who will not take the time to read and study cannot expect to understand the subject, no matter how many questions they may ask. Questions without research and thought are idle.

It is generally admitted that the ignition is at present the most bothersome part of a gasoline motor for the novice to handle, and some manufacturers advocate a single cylinder motor for this reason alone. Although admitting that for general purposes of construction the two-cylinder motor is to be preferred, they believe it is easier to study the electric ignition with one cylinder than with two.

The transcontinental tourists have abandoned their world-shaking trip and returned to private life. The whole scheme was an egregious blunder for all concerned, discreditable to the promoters and to the industry in general, and the sooner it is forgotten the better.

The Coast is Clear.

With the exception of New York State, the coast is apparently clear for the motor vehicle throughout the United States. License laws and speed laws are being discussed and will in some instances be enacted, but from the present outlook the motor vehicle will not be burdened with adverse legislation to any great extent, nor for any great length of time. Speed laws are reasonable and necessary; license laws are not with the probable exception of some classes of steam vehicles which may have to be subjected to some kind of supervision by the authorities.

In point of legal status, therefore, motor vehicle manufacturers have little cause for complaint and it will be their own fault if the coast does not remain clear for them.

Horse Power Tests.

La Locomotion Automobile has organized a competition to determine the actual horse power developed by vehicle motors and the amount of power delivered at the rim of the wheel.

The tests will begin on Oct. 9 at 103 Avenue de la République, Aubervilliers, Seine, and all builders and owners of motor vehicles may enter. No entry fee will be charged. Experts will have charge of the tests, assisted by the makers or owners of the vehicles.

Diplomas recording the results of the tests will be given to the participants.

LONDON NOTES.

LIVERPOOL HEAVY MOTOR TRIALS.

London, Aug. 11.

The attention of the motor vehicle world on this side has recently been centered on the trials of heavy motor vehicles carried out at Liverpool under the auspices of the Liverpool Self-Propelled Traffic Association. The trials were divided into four different classes—(1) minimum load 2 tons, maximum tare 2 tons, minimum level platform area 50 sq. ft.; (2) minimum load $3\frac{1}{2}$ tons, maximum tare 3 tons, minimum level platform area 65 sq. ft.; (3) minimum load 5 tons, maximum tare 3 tons, minimum level platform area 80 sq. ft., and (4) minimum load $6\frac{1}{2}$ tons, maximum tare 4 tons, minimum level platform area 110 sq. ft. Altogether 11 entries were received, but only 6 of these turned up, the absentees including the vehicle entered by the Graham Equipment Co., of Boston, Mass. The competing vehicles were: Class 1—A steam lorry, by T. Coulthard & Co., of Preston. Class 2—Bayley, Ltd., London, S. E., steam lorry; the Clarkson-Capel Steam Car Syndicate, Ltd., London, S. E., steam lorry; the Lancashire Steam Motor Co., Leyland, steam lorry, and the Steam Carriage & Wagon Co., Ltd., Chiswick, steam lorry. Class 4—The Steam Carriage & Waggon Co., Ltd., steam lorry and trailer. The trials extended over three days—Monday, July 31; Tuesday, Aug. 1, and Wednesday, Aug. 2. On Monday the programme consisted of a hill-climbing contest in a hilly district on the outskirts of Liverpool. The course was only about a mile or so long, but included some very steep gradients, ranging from 1 in 9 to 1 in 17. On Tuesday and Wednesday the programme consisted of runs of about 35 miles with a compulsory stop of about three-quarters of an hour midway. It was generally conceded by those who witnessed the tests, including representatives from the British war and post offices, and of a number of municipal bodies, that great progress has been made in the construction of heavy motor vehicles since last year's trials. While on that occasion breakdowns were the order of the day, the trials of last week were carried through without serious incident of any kind. The judges awarded the gold medal in Class 2 to the Steam Carriage & Waggon Co. for their Thornycroft steam lorry, and silver medals to Messrs. Bagley and the Lancashire Steam Motor Co. The only other award is a gold medal in Class 4 to the Steam Carriage & Waggon Co. for their Thornycroft steam lorry and trailer.

THE NEW BOLLÉE.

La Société des Vorturettes Automobiles, of Paris, makers of the Bollée vorturettes, have lately introduced a new form of the latter, viz., a double-motor vehicle. Instead of one engine, two are employed in the new vorturette, one on each side of the rear wheel, each motor possessing its own carbureter, exhaust box, etc., while the fly wheel and governor are arranged centrally under the seat. The pressure tank is located behind the front seat, as usual, but the gasoline tank is now carried on the mud guard of the rear wheel. No alteration has been made in the driving gear, but two brake shoes are provided in place of one, hitherto used.

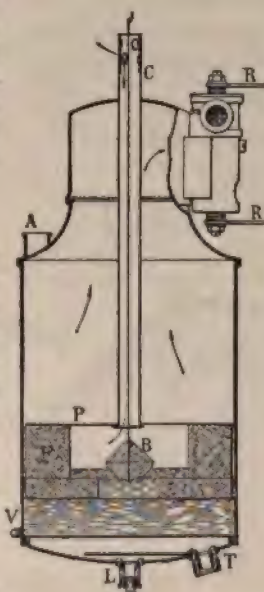
LIVERPOOL TO LONDON.

An interesting long-distance trial was recently made by one of the steam lorries which took part in the trials of heavy

wagons at Liverpool. The vehicle—Clarkson & Capel's steam lorry—was loaded up with about 3 tons crystal carbonate of soda at the works of Gaskell & Deacon, near Liverpool, the same being consigned to a firm in London. The metropolis was reached on the third day without any serious delays, an average speed of over 5 miles an hour having been made.

THE ASTER CARBURETER.

In connection with the Aster gasoline motor for tricycles, which is just now competing very keenly with the De Dion, a special form of carbureter is employed, of which two views are given herewith. The advantage claimed for it by the makers, Les Ateliers des Constructions Mécaniques "L'Aster," of 33 Cours Benoist, St. Denis (Seine), France, is that, in contradistinction to many other carbureters, it will work regularly, even when the tricycle is traveling over rough roads. The device, which also serves as the storage tank, consists of a copper cylinder of a capacity of 5 liters. The gasoline is introduced at A. F is a float of special form, the top of which carries a copper plate, P. To the latter is fixed a tube, C, which extends to the top of the tank, passing on its way through a diaphragm. The tube C is pierced at its upper end with a number of small holes covered with a wire gauze. Within the tube C is a rod, terminating in a small conical cork float, while at the top of the outside of the tank is a double valve, one part of which controls the admission of fresh air, while the other controls the quantity of carbureted air allowed to pass to the explosion chamber of the motor. The tank is provided with a double bottom, a portion of the exhaust gases being conveyed through it to give a slight preliminary heating to the gasoline. The air drawn in by the suction stroke of the motor enters by the pipe C, and passing down the tube meets and is dispersed by the float B over the surface of the gasoline. The carbureted air then rises into the dome of the tank, passing through a wire gauze, which serves to prevent any chance of a return flame to the carbureter. From the dome the carbureted air passes through the double valve to the explosion chamber in the desired quantity and mixed with the requisite amount of fresh air.



ASTER CARBURETER.

If there is any town in England which is going strongly in favor of horseless vehicles, it is Newcastle-on-Tyne. Already a number of motor vehicles are plying for hire in that city and district, while now another company—the Newcastle & District Motor Car Co., Ltd.—has just been formed with a capital stock of \$50,000 to establish additional motor service for the transport of both passengers and goods in the district.

As a finale to a recent 50-kilometer race for electric vehicles around Paris, it was decided to run the vehicles around the Longchamps track until the batteries were exhausted. Five vehicles competed, and, including the 50-kilometer road test, one charge of the batteries of the Bouquin-Garlin-Schiore carriage sufficed for a run of 78¾ miles. The second best run was made on a Columbia carriage, the total mileage in this case being 71¼ miles. No particulars are available as to the number and capacity of the batteries used.

I note that Mr. Lawson, the famous promoter, has broken out in a new place, a company having just been registered with the title "Automobiles (Lawson's) Ltd.," with a nominal capital of \$500. It is not quite clear to the outsider what the objects of the new company are.

Automobile Club of America, Incorporated.

Last week papers were filed with the Secretary of State at Albany, N. Y., incorporating the Automobile Club of America, with headquarters in New York city.

The directors of the club are Frank C. Hollister, Charles R. Flint, George M. Smith, Winslow E. Busby, Whitney Lyon, George F. Chamberlin, Homer W. Hedge and William Henry Hall, of New York, and V. Everitt Macy, of Scarborough on the Hudson.

The constitution and by-laws have already been printed in *The Horseless Age*.

Motor Wagons to Move the Cotton Crop.

It is reported that one of the leading cotton firms in the South has decided to invest in six motor wagons, to be employed in moving the cotton crop between Augusta, Ga., and Charleston, S. C. Meanwhile two steam carriages have been purchased for use by the cotton buyers in going from one plantation to another independent of the railroads.

Transcontinental Tour Abandoned.

Mr. and Mrs. John D. Davis, the adventurous pair who undertook to cross the continent in a motor carriage, and whose mishaps and tribulations have filled the columns of the newspapers of the country for the past five or six weeks, have decided to abandon the experiment. They reached a point beyond Toledo, O., when fresh troubles occurred, although the machine had been overhauled at Cleveland, O.

Automobile Parade at Newport.

On the evening of Sept. 7, immediately after the closing of the Horse Show at Newport, R. I., an automobile parade will take place, in which some 30 or 40 members of the 400 are expected to participate.

Winton Chicago-New York Run Postponed.

The proposed fast run from Chicago to New York, which Alexander Winton and Chas. B. Shanks, of the Winton Motor Carriage Co., of Cleveland, O., were to make to demonstrate the efficiency of the motor carriage for carrying messages and mails in time of war, has been postponed until a later date, Mr. Winton having been called home by important business.

Brooklyn Automobile Club.

Brooklyn, N. Y., is to have an automobile club. J. B. Hoecker, Dr. J. L. Zabriskie and Mr. W. M. Hutchinson, owners of motor carriages and enthusiastic students of the subject, are the prime movers in the enterprise, and the objects of the organization will be not social, but looking rather to the study and improvement of the machines.

Fairmount Park Exclusion Law a Dead Letter.

The rule excluding motor vehicles from Fairmount Park, Philadelphia, Pa., is virtually a dead letter. Motor carriages have repeatedly been driven through the drives since the commissioners took their adverse stand without being molested by the police. In one case, however, when an automobilist was stopped by a policeman and taken to the guard house, the sergeant did not arrest him, and he was allowed to proceed on his way. Nor have any accidents been reported so far as a result of the appearance of the interdicted vehicles within the confines of the park.

MINOR MENTION.

Rev. A. S. Parsons, Berkeley, Cal., is having a motor gospel wagon built for himself by a San Francisco firm, with which he will tour the State.

The Keystone Wagon Works, Reading, Pa., are considering the advisability of taking up the manufacture of motor trucks and delivery wagons.

The electric carriage of the Kensington Bicycle Co., Buffalo, N. Y., is now said to be ready for the market. It is a light vehicle of tubular construction.

Manager Boldt, of the Waldorf-Astoria Hotel, New York, has given quite a large order for electric vehicles, which will displace the horses now used by the famous hostelry.

Charles F. Saul, a prominent vehicle dealer of Syracuse, N. Y., is building two experimental carriages, one electric, the other gasoline, and intends to manufacture both kinds.

Interviews are going the rounds of the press outlining the prospectus of a \$25,000,000 company called the National Automobile Co., which, it is stated, is soon to be incorporated in New Jersey and commence the manufacture of motor trucks in various large cities of the Union. What the motive power is to be is not hinted at, but it is said the main factory will be in Chicago.

The Whitcomb Valveless Motor.

Geo. A. Whitcomb, of Framingham, Mass., has succeeded in designing and perfecting a new petroleum gas motor for motor vehicles, an illustration of which is given in this article. It is intended for and especially adapted to the propulsion of all vehicles, from the bicycle up to the heaviest delivery. No water jacket is used for vehicles requiring less than 8 h.p., the motors being applied in battery form in such a manner that should one become disabled it is but the work of a moment to cut it out and proceed with a slowed gear at a less rate of speed. For heavy delivery it is proposed to use water jackets and build the motors of any size required, as there is no objection whatever where lightness is not the first consideration.

There are no valves to open or close; consequently, the inventor states, it can make long runs at greater speed, if desired, and with less danger of becoming disarranged in any of its parts.



The construction consists of a simple cast iron cylinder provided with suitable radiating surface or water jackets sufficient for cooling; and supplied with proper inlet and exhaust ports for the distribution of the gas and the extraction of the burnt gases. The cylinder is bolted to a plain cylindrical casing, preferably of aluminum, which contains the cast iron disks that serve as balance wheels and carry the crank pins. An ordinary reciprocating piston, with suitable cut-offs, is given a slow rotary motion, and it is this helicoid movement that alternately opens and closes all the supply and exhaust ports, thus doing away with the necessity of all valves, which have hitherto proved to be the most formidable obstacles to the smooth and uninterrupted road work of the petroleum gas motor. It is a well-known fact that a reciprocating body if given a spiral movement moves with about one-half the friction. For illustration, if a wire nail be driven into a plank

and drawn out straight, and then driven in again and given a twist as it is withdrawn, it will be seen at once which is the easier.

This motor is said to run with very little friction, requiring no power whatever to open the exhaust, to be fully up to the power of any cylinder of the same capacity yet brought out, and for simplicity of construction and cost of manufacture to be unrivaled by anything at present on the market. The inventor says the experimental motor never has been changed from the original design on paper, which shows a remarkable absence of defects which are usually encountered in most new inventions. Four carriage motors of 1 h.p. each, the minimum and maximum speeds being 200 and 1,200 respectively, are in process of construction and will be finished and applied to light vehicles seating two persons each. Two speeds forward and one backward will be used in the transmission, with throttling of the mixture and hastening or retarding the ignition for the intermediate speeds. Both being connected to the same lever will give an intermediate change in speed, if desired.

The Commissioner of Patents at Washington has allowed the inventor 16 claims on this unique motor, and all manufacturers and intending manufacturers of motor vehicles are referred to an advertisement in another column of this journal in regard to the manufacture under this patent.

Chicago License Law Goes Into Effect.

Mayor Harrison, of Chicago, has signed the bill requiring a license from drivers of motor vehicles.

The ordinance provides for the licensing of motor drivers, the fee being \$3 for the first year and \$1 for renewals. The city electrician, the city engineer and the commissioner of health are made a board of examiners to examine into the qualifications of operators seeking licenses. The license will be a certificate of qualification for operating a motor vehicle. Only one examination is necessary.

The speed of motor vehicles is set down within the city limits at not more than 8 miles an hour. The rules of the road must be observed. Each car must be equipped with gongs, to be sounded at every street crossing. Brakes must also be provided, which must be powerful enough to stop the vehicle going at full speed within 10 ft. of the place where the brakes were first applied. Operators not having certificates of qualification are liable to a fine of not less than \$5 nor more than \$25 for each offense.

Drivers of Steam Vehicles Under Control of the Inspectors.

In the State of Colorado an engineer's license is required of one who is to operate a steam engine, but the authorities at Denver, who have been approached regarding their attitude toward steam vehicles, take the ground that while no written license will be required, it will be necessary for the party wishing to use such a vehicle to present himself before the inspectors and satisfy them that he understands his machine and can safely be intrusted with it upon the public highways.

Pneumatic Cushions to Prevent Vibration.

William N. Amory, secretary of the Third Avenue Railroad Co., New York, is the inventor of a means of preventing vibration in motor vehicles, which he believes is superior to the pneumatic tire in resiliency and much cheaper. It consists of a number of pneumatic cushions placed under the body of the vehicle in lieu of springs. Several illustrations are here given showing how the invention is applied to a vehicle.

No. 1 is a cut of the pneumatic cushion. The exact size of the particular cushion from which the cut was made is: Total diameter $6\frac{1}{2}$ in., total height $2\frac{1}{2}$ in. The cushion is blown up with an ordinary bicycle pump. The cushions can be made of such size as is found most suitable. That above described is shown drawn to the scale in all the drawings herewith.

No. 2 shows the principle applied to a motor vehicle built without springs, the cushions being substituted for and taking the place of springs.

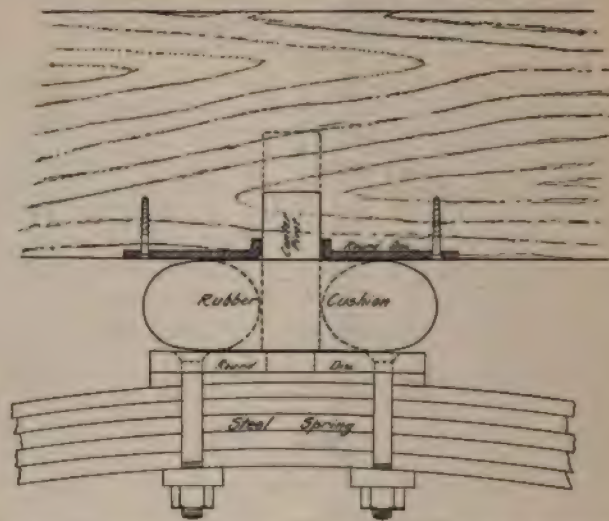
Drawing No. 3 shows the cushions applied to a motor vehicle, having the ordinary form of springs, and drawing No. 4 is supplementary to drawing No. 3, showing one method by which the pneumatic cushion can be attached to ordinary carriage springs.



PNEUMATIC CUSHION.

As a means for preventing vibration in vehicles, a steel plate (preferably of the diameter of the cushion) is solidly connected to the running gear, while an upper steel plate of like dimensions is connected to the carrying part of the vehicle, the pneumatic cushion being placed between the two plates. A post or sliding standard is attached to the upper plate and is adapted to slide loosely through the center hole of the cushion and snugly through the center hole of the lower steel plate, or the sliding standard can be permanently attached to the lower plate and play upward through the cushion and through the upper plate, which method is shown in cut 5. The former method is preferable, however. With the cushions so attached to the vehicle all shock and all vibration incident to ordinary use are said to be taken up and dissipated.

The action of the cushions is as follows: Vibrations, as they are received from the ground and transmitted upward, are received by the cushions before they reach the body of the vehicle and are completely absorbed by reason of the air pressure upon the sides of the cushions, which occurs at right angles to the line of shock, and which causes the walls of the cushions to stretch and yield to the shock in a radial direction.



No. 4.—SHOWING HOW CUSHIONS MAY BE ATTACHED TO ORDINARY CARRIAGE.

These pneumatic cushions are calculated to take the place of the ordinary steel springs used on vehicles, entirely superseding them. An economy in manufacture is thus obtained, while a much larger measure of comfort and ease is claimed for the rider. The cushions can be made of any size and strength desired. In the illustration four of them are shown attached to the vehicle, but a larger number can be used if desired.

With the use of these cushions in place of springs the inventor claims that the heavy and costly pneumatic tires which are now used upon nearly all motor vehicles could be entirely dispensed with and solid tires used instead of the pneumatics, inasmuch as a larger degree of resiliency, comfort and ease are obtained with the cushions than can be had with the joint use of steel springs and pneumatic tires upon any vehicle.

The principle of this invention has been adapted to bicycles, the pneumatic cushion being applied to the saddle post. This device is on the market and is known as the Monty pneumatic saddle post.

None of the difficulties that exist in the application of the invention to bicycles are found when applied to other vehicles. The problem with the bicycle was to locate a single cushion in the center of the line of main shock, which was successfully accomplished, but the size of the pneumatic cushion was necessarily limited and its shape qualified. Its application to ordinary vehicles, whether motor or moved by animal power, is comparatively simple.

Excessive vibration is one of the most serious faults in all motor vehicles, and is a problem the solution of which has been sought in vain by old-line carriage manufacturers. These pneumatic cushions are claimed to accomplish the desired results. One or two manufacturers have already been supplied with these cushions and are preparing to test them upon their vehicles, and the inventor will gladly furnish them to manufacturers of motor vehicles who wish to test their efficiency and practicability.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

MINOR MENTION.

Paducah, Ky., is to have a motor vehicle service.

Will Taylor, Niles, O., has invented a motor carriage.

Curtain & Schille, Columbus, O., are building an electric carriage.

Suburban motor omnibus services are projected at Philadelphia, Pa.

The Akron Machine Co., Akron, O., are testing their gasoline carriage.

Carlisle, Pa., is said to be taking steps to establish a motor vehicle factory.

Gasoline mail wagons of Haynes-Apperson make are to be introduced at Kokomo, Ind.

The Standard Motor Carriage Co., of Boston, Mass., are likely to locate in Reading, Pa.

John Leck, Santa Ana, Cal., is endeavoring to build a motor carriage to weigh only 125 lbs.

Harry B. Strong, an 18-year-old genius, of Scranton, Pa., has constructed a gasoline carriage.

The Belknap Motor Co., Portland, Me., are to embark in the manufacture of electric vehicles.

Grout Bros., Orange, Mass., are to furnish motor stages to ply between Orange and Athol, Mass.

Wilbur F. Arnold, New Britain, Conn., has applied for a patent on a gasoline tricycle weighing 200 lbs.

M. L. Huddleston, 406 Fifth St., Louisville, Ky., has built a motor vehicle from the parts of two bicycles.

Prominent business men of Warren, O., are said to be contemplating the erection of a motor vehicle plant.

The Kirk Mfg. Co., Toledo, O., makers of the Yale bicycles, are contemplating the manufacture of motor vehicles.

The McLearn & Kendall Co., Wilmington, Del., are said to be contemplating the manufacture of motor carriages.

J. W. Bonta, Wayne, Pa., has invented a compressed air motor, which he believes will revolutionize vehicle propulsion.

Frank Stutzman, of Eliot & Stutzman, Williamsport, Pa., has built an experimental carriage with a friction disk transmission.

A new West Virginia incorporation is the English Automobile and Motor Co., of Chicago, with an authorized capital of \$5,000,000.

Dr. Truman J. Martin and others will organize the Buffalo Electric Vehicle Transportation Co., of Buffalo, N. Y., with \$1,000,000 capital.

The Keller Electrical Shops, Canton, O., will be devoted to the manufacture of electric vehicles, according to the statement of a local newspaper.

Charles Logue, chief of the Repairs Department of Public Buildings, Boston, Mass., is now using a Stanley "Locomobile" in making his rounds.

THE HORSELESS AGE.

Vol. 4, No. 21, Aug. 23.

The article headed "Like Ball Bearings for Motor Vehicles," which appeared in a recent issue of this journal, should have read "Lake Ball Bearings."

A. L. Barber, president, and Herbert N. Searles, mechanical engineer of the Locomobile Co. of America, are in England establishing a European branch.

The Pittsburg, Allegheny & Stowe Township Ferry Co., of Pittsburg, Pa., will probably operate 30 to 40 motor vehicles in connection with its ferries to McKees Rocks.

A new corporation in New Jersey is the United States Standard Motor Vehicle Co., capital \$25,000; incorporators, Eli Teeker, Hugo Stommell and De Forest P. Lozier.

Otto Bayersdorfer, a bicycle repairer of Omaha, Neb., has a light gasoline carriage nearly completed. R. Jensen, a jeweler of the same city, is also building a gasoline carriage motor.

S. T. Lloyd, a lawyer, of Atwood, Kan., is organizing a company to operate a gasoline motor stage line from Trenton, Neb., to Colby, Kan., a distance of 65 miles, to be covered in one day.

It is reported that the recent increase in the capital of the Western Electric Co., of Chicago, from \$3,500,000 to \$8,000,000 was due to the company's intention to enter the electric vehicle field.

Alexander Winton, of the Winton Motor Carriage Co., Cleveland, O., is putting in his spare time on a racing carriage, with which he expects to meet all comers, French or otherwise. It will be completed in the early fall.

The Waltham Mfg. Co., Waltham, Mass., have issued a handsome catalogue of their "Orient" tricycles, tandems, etc., constructed after the De Dion & Bouton models. They are also agents for the De Dion & Bouton motors.

Henderson Bros., carriage builders, of Somerville, Mass., have secured the Jeantand electric vehicle patents for the United States and will erect a large plant for the production of heavy business vehicles under these patents.

The United States Express Co. are introducing the Woods electric wagons in New York city. The wagons, which are already in operation in Baltimore, Washington and Philadelphia, will be introduced in other cities of the East.

Careful tests of the new Sperry electric carriages are being made at the factory of the Cleveland Machine Screw Co., Cleveland, O. The carriages are proving very satisfactory, the simplicity of the control being particularly commended.

The Mobile Co. of America, who are building a factory at North Tarrytown, N. Y., for the manufacture of Stanley steam "mobiles," are pushing the erection of their plant with all possible energy, and expect to be turning out carriages this fall.

A committee of five, consisting of E. H. Winship, O. E. Clark, F. S. Jacks, H. P. Goodman and H. C. Horstmeyer, has been appointed at Napa, Cal., to investigate the motor vehicle with a view to establishing a factory for their manufacture in that city.

There are two motor carriages in the mining region of Cripple Creek, Colo. One is a Haynes-Apperson carriage, owned by a real estate dealer of Victor, the other is the gasoline machine built by Robert Temple, of Denver, for a doctor of Cripple Creek.

Postmaster Dickerson, of Detroit, Mich., has had a motor mail carrier designed, and if the scheme is approved at headquarters he will introduce a motor mail service in that city. Lawrence Nash, one of the department's postmen, is the designer.

Isaac L. Rice has resigned the presidency of the Electric Storage Battery Co., and George H. Day has been chosen to succeed him. The reason given by Mr. Rice for his retirement was the growth of the business of the Electric Vehicle Co., of which he is president.

Isaac A. Remsen, the prominent carriage dealer, of Brooklyn, N. Y., and Everett A. Cooper and Frank Carlough, have incorporated the New York Wagon Co., under New Jersey laws. The capital is \$25,000 and the plan is to include motor vehicles among its manufactures.

Chicago has a new motor vehicle manufacturing company—The Howard H. Brown Automobile Co.; capital, \$100,000; incorporators, Howard H. Brown, A. L. Kull and Harold A. Smith. This company has secured the plant of the Elgin Sewing Machine and Bicycle Co., Elgin, Ill.

The Tractor Truck Co. has been incorporated at Trenton, N. J., with \$2,500,000 capital stock to operate motor vehicles for the conveyance of passengers, freight and express matter. The incorporators are T. Henry Dixon, J. Bansall Taylor, C. Berkeley Taylor and Geo. H. B. Martin.

The electric carriage of E. C. Stearns & Co., bicycle manufacturers, Syracuse, N. Y., has been successfully tested, and the company has decided to enter upon the manufacture of electric vehicles. Wire wheels are used, and a 4 h.p. motor. The weight of the vehicle is about 2,000 lbs.

The Philadelphia Motor Carriage Co., Philadelphia, Pa., has been formed to buy and sell electric vehicles. The capital stock is \$1,000,000, and the incorporators are C. P. King, of Philadelphia, Pa.; J. T. McGraw, C. R. Durbin, F. H. Treat and Claude S. Jarvies, all of Grafton, W. Va.

The Detroit Automobile Co. has been formed at Detroit, Mich., to build a gasoline carriage invented by Henry Ford, engineer of the Edison Electric Light Co.'s plant, same city. C. A. Black is president; A. E. F. White, vice president; S. S. Delano, treasurer, and Frank R. Alderman, secretary.

The Lanchester Motor Co., of Pittsburg, Pa., who have secured the United States, Canadian and Mexican rights under the oil motor patents of F. W. Lanchester, Birmingham, England, will erect a \$400,000 plant at once. The motors turned out will be adapted to heavy trucks and street cars.

The Cleveland Automobile Co., recently organized at Cleveland, O., has leased the property of the old Cleveland Athletic Club, on Euclid Ave., and will refit it for an automobile club house and training school. A motor livery business will also be established and trained drivers will be furnished to patrons.

Pennsylvania capitalists have organized a \$500,000 company to manufacture motor vehicles at Chattanooga, Tenn. The Harding Mfg. Co., Nashville, Tenn., manufacturers of agricultural implements, will be consolidated with the new enterprise. A large tract of land has been donated by the Chattanooga authorities.

W. H. Chapman, a jeweler, of Portland, Me., has built an electric carriage, weighing 380 lbs., and capable of making 20 miles on one charge on level roads. Two half h.p. motors, 180 lbs. of storage battery, 32-in. wire wheels and 4-in. pneumatics are used. Three forward speeds—8, 10 and 12 miles an hour—and one reverse are provided.

The Baltimore Automobile & Mfg. Co., Baltimore, Md., has been organized with \$100,000 capital to build, operate and sell electric vehicles. A central station will be erected and a repair shop fitted up, where vehicles of patrons may be cared for. Delivery wagons will be a specialty, though a cab service will also be introduced. The general offices are at 515 Equitable Bldg., and Joseph M. Zamoiski is general manager of the company.

The Pittsburg Motor Vehicle Co., Pittsburg, Pa., has been reorganized under the name of the Auto-Car Co., with a capital stock of \$1,000,000. The directors of the new company, which will absorb the old one, are: Charles J. Clarke, L. S. Clarke, J. Denniston Lyon, William Morgan and F. K. Fittler. William Morgan has been elected secretary and treasurer, and a plant to employ 500 men will immediately be constructed.

The Equitable Auto Truck and Power Co. has purchased the old Bennett & Barnard factory with a large tract of adjacent land in Lynn, Mass., and will at once transfer to that place all its machinery now under contract at Troy, N. Y., and West Chester, Pa. About \$175,000 will be expended on the plant and 300 to 350 hands will be employed in the manufacture of steam carriages, brake and power controllers and automatic couplers.

Mississippi Valley Automobile Transportation Company.

An important organization in the western section of the country is the Mississippi Valley Automobile Transportation Co., of St. Louis, with a capital of \$500,000, who will operate electric and other vehicles, principally in St. Louis. They have made arrangements with the Woods Motor Vehicle Co., of Chicago, successors to the Fischer Equipment Co., for a supply of their cabs and carriages, the latter to be leased to private parties and the former to be introduced for public hire. Delivery wagons will also be leased to local merchants under the care of the company's experts.

Herbert A. Wagner, the president, is general superintendent of the Missouri Edison Electric Co., and one of the largest stockholders of the Wagner Electric Co. The secretary and treasurer is H. R. Gamble.

COMMUNICATIONS.

Questions of Power and Transmission.

Baltimore, July 31, 1899.

Editor Horseless Age:

I wish to build a 2-cylinder gasoline motor for a carriage, upright cylinders and of the 4-cycle type. Please be kind enough to give me the following information through your issue:

- (1) How much power should the motor develop for a light carriage for 2 persons, to make a maximum speed of 20 miles per hour?
- (2) Give size of cylinders (bore and stroke) and number of revolutions per minute which you would advise.
- (3) In using the belt system for transmission, what size (width) belts are generally used for the above size vehicle?
- (4) Also, how much compression space should there be in the cylinders (cylinder heads)? Yours respectfully,

JOHN HOFSSASS, JR.

Answers: At this present writing the art of motor vehicle construction is not so well established by rule and precedent as to permit the ready and certain conclusion that a machine when built will act exactly as the calculations would advise. Different builders get varied results from the same dimensions of engine cylinders, etc., and the gasoline motor is liable to act entirely at variance on the carriage to what it did in the shop, as told by Mr. Roots in his reminiscences, published recently in *The Horseless Age*.

The traction coefficients deduced from tramway and railroad practice are woefully misleading when applied to highways, and the figures give results altogether inadequate.

Even the resistance of the air, which becomes an important factor at high speeds, is placed at widely varying values from the 36 lbs. to the square foot exerted by a 60-mile-per-hour wind, given by Smeaton, to the 10 or 12 lbs. ascribed by other investigators to wind of the same velocity.

Even the long established belief that the pressure varied as the square of the velocity has been doubted, some experimenters claiming that the wind pressure should be considered as varying directly as the velocity, and the same difficulty applies to belting as to the rest. The horse power of a belt is usually given as a product of the width and speed; but the pliability of the belt, the even tension on each part of the cross-section, the arc of contact and the condition of both belt and pulley surfaces, the total tension and the condition of joint all enter into the case. In the *Transactions of the American Society of Mechanical Engineers*, Vol. 12, appears the following, which is highly apropos:

Formulæ are useful for proportioning belts and pulleys, but they furnish no means of estimating how much power a particular belt may be transmitting at any given time, any more than the size of the engine is a measure of the load it is actually drawing, or the known strength of a horse is a measure of the load on the wagon."

If the several who have made actual experiments in this way could be induced to send the observed facts to *The Horseless Age* for tabulation, the data would, when combined, be much more useful to each of them than the little they now possess. From consideration of some successful gasoline motor vehicles, would suggest in answer to the questions:

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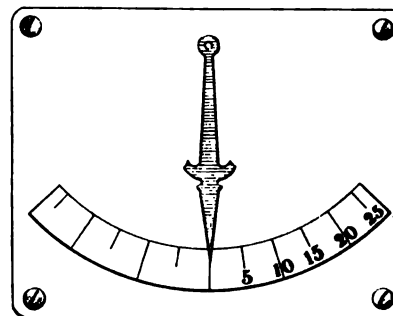
1. Divide the total weight in pounds, of wagon and passengers, by 250. If total weight equals 1,000 lbs., then $1,000 \div 250 = 4$ h.p. Ans.
2. If 4 h.p., $4\frac{1}{2} \times 4\frac{1}{2}$. Arrange contacts so that speed may be varied from 200 to 900 revolutions per minute.
3. Two inches. Use largest pulleys design will permit.
4. See *Horseless Age*, page 17, May 24, 1899. R. I. C.

A Grade Meter.

Westfield, Mass., Aug. 12.

Editor Horseless Age:

I am offering a little suggestion for an attachment which I think would be much appreciated by users of motor vehicles. I inclose you a rough sketch of the same, which is nothing more nor less than a meter to determine grades.



GRADE METER.

It consists of a pointer or pendulum, following the scale marked 5, 10, 15 per cent., fastened to the carriage at any convenient place, preferably in sight. As the carriage ascends a grade the pointers, actuated by gravity, will point to whatever grade is being ascended.

Very respectfully,
GILBERT J. LOOMIS.

Buffalo, N. Y., Aug. 16, 1899.

Editor Horseless Age:

I see an article in *The Horseless Age* of Aug. 9 headed "Favors Better Mufflers," in which you refer to a muffler which completely stops all noise of exhaust and at the same time gives no back pressure.

We are very much interested in this direction, and would be much pleased to have any information in reference to same, or where they may be obtained.

We have been investigating in this direction for some time, but have not come across any sufficiently perfect muffler for our work. Yours truly,

THE BUFFALO SPRING & GEAR CO.

WANTED.

Special contributors to *THE HORSELESS AGE* on all important subjects relating to Motor Vehicles. Fair compensation. Address *THE HORSELESS AGE*, 150 Nassau Street, New York.

MACHINERY and TOOLS for motor vehicle builders

Readers using information from this department are requested to give credit.

LATHE WORK.—III.

By Robert I. Clegg.

In the present stage of manufacturing the lathe is less in evidence, though no less a valuable factor, in modern machine shop work. Special tools, designed throughout with particular care to but the few operations upon machinery parts for which there is much demand, have ousted the lathe from many of the positions formerly held in the factory. In the smaller shops the lathe is still supreme, and whilst the remarkable adaptability of the machine is generally recognized, due advantage is not always taken of the capacity of this particular tool.

There is a machine shop making a specialty of electric motors of the smaller sizes—from 1 to 10 h.p. The armature shafts are long and slim; cut off, centered, turned up and finished in the lathe.

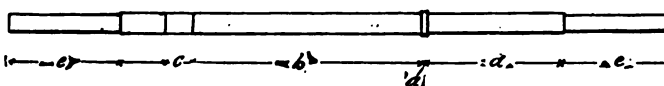
The appearance and purpose of one of the smaller shafts, judging from a cursory examination, were as given in the sketch, Fig. 1.

At a the shaft is left the full size of the compressed steel shafting from which the length is cut, b is turned down for

the wrought iron disks forming the core, c is threaded for the nut, and d fits the commutator, whilst e e are the bearings.

The lathe had a $\frac{1}{2}$ -in. hole through the spindle, and therefore the stock was cut up into the desired lengths by gripping one end of the shaft in the chuck jaws, using the back rest to support the overhanging length close to the carriage slide, having an offset tool. The cutting operation was neatly and quickly accomplished. Time was required, however, to adjust the back rest. To loosen the bolts and move the rest becomes even more troublesome with the increase in the size of the shafts, and, of course, this operation must be repeated with each piece cut off.

Fig. 1



After all the pieces were cut off they were faced up on the ends, and then centered by means of a square center in tail stock, the center hole being afterwards drilled and reamed; the square center being removed and a drill chuck with taper shank being substituted.

During the roughing out the back rest remains stationary for each operation, and if the rest is brought as close as possible to tool, considerable time is taken up in adjustment.

It may be set down as a machine shop maxim that as soon as a particular task assumes familiarity through repetition, just so soon does the demand arise for improvements in the methods adopted. In the first place a suitable follow rest was most desirable for the lathe work under consideration; the form of follow rest is largely decided by the design of lathe; the rest, where the slide projects but little in back of the tool post, can be placed directly upon the saddle and doweled in that position. Where this arrangement is impracticable, then

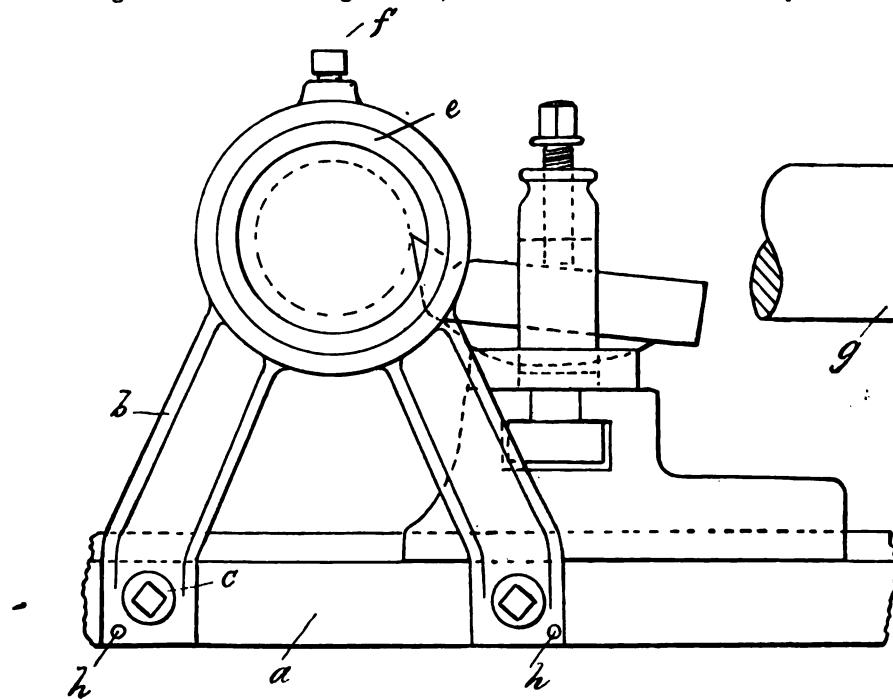


Fig. 2

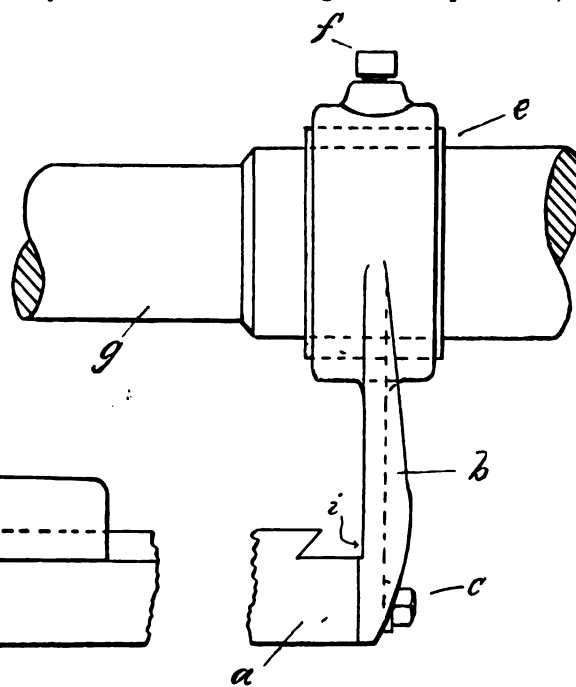


Fig. 3

a follow rest may be bolted to side of saddle, due allowance being made for the slight overhang of the slide, or the circular base of the compound rest, as the case may be.

Figs. 2 and 3 show a follow rest of this kind, a a being the saddle of lathe carriage to which the rest b b is attached by means of the collar screws c c and the dowel pins h h.

The hub is bored after the rest has been permanently fastened to the saddle. The holes for collar screws and dowels are first laid out in b, then drilled; the rest is then clamped to saddle and a straight shaft placed between lathe centers; by measuring from this shaft or from a bushing placed thereon—the bushing may be small enough to pass through hole in b—the rest can be placed in position approximately. Saddle is then removed, and using the holes already drilled as a jig the holes for screws are drilled out and tapped. Replace the saddle after dowels are put in rest and by means of a boring bar placed on the lathe centers the hub is to be carefully bored, the carriage being fed along by power in the ordinary way.

The bushings e e are cast iron, are first bored to size required, then turned on mandrels to fit the following rest, and when held from rotating by the set screw f will keep the work in good alignment with the rest of the lathe. In Fig. 2 the shaft is removed, the dotted line and diamond point indicating the operation when tools are in action, as in Fig. 3 at g. At i in Fig. 3 attention is directed to the offset in order that the proper amount of clearance may be given to the cross slide.

A rest large in proportion to the lathe has been selected for illustration; a much smaller one is a convenience for shafts of considerably less diameter, thereby making it an easier and less expensive job to get out the needful bushings.

It will be seen that when a length of shaft has been cut the carriage can be fed along the shears and another cut taken; there is no adjustment required and everything is ready for business as soon as screwed down. Instead of using a square center in tail stock, a tool should be made, to fit in tool post, having a point similar to a half-round center reamer, then the shaft being supported by the rest a center hole may be truly made, and if left slightly under size a combination drill and countersink held preferably in a sensitive upright drill press will produce excellent results.

If the sensitive drill is "conspicuous by its absence," then a drill chuck, fitted to foot stock spindle, will to a limited extent supply the deficiency. The follow rest could be fitted with a special bushing, with full size opening on one side only, the other end provided with a hardened steel bushing to fit body of the combination drill; the centering tool in tool post would not be necessary in this plan, but, on the other hand, additional bushings would be required, one for each size, and it is doubtful if under all the circumstances the results would be so good.

The follow rest need not be heavy; the ribs could be three-sixteenths by five-sixteenths; the back being also five-sixteenths; leave not less than three-sixteenths to bore out of hub, so that the outside shell when finished would be at least one-quarter inch thick.

An armature shaft should be roughed down on the ends and finished to size in the middle only, as a first operation, because there is sufficient inequality in the disks, when put together in bulk, to slightly spring the shaft when the nut is tightened. The bearings ought to be finished by grinding.

Whilst the tail stock is being mentioned, attention may be called to a very provoking and easily remedied defect found

on many lathes. The bolts holding down the tail stock are frequently of considerable length; when the tail stock is loosened and moved along the bed the bolts swing more or less, and unless the nuts have been slacked back far enough the clamp will swing against the ledge and wedge until the tail stock is pulled in the opposite direction or the nuts released still further.

Of course, if the oscillation can be stopped the difficulty is at once removed; therefore, take the tail stock off the bed, if it acts in the annoying manner already described, fit in the box frame two rods—pieces of wood will serve—so as to form a slot crossways of the lathe. This will not interfere with setting over the tail stock for taper turning, and will not be in the way of any useful purpose, but the pendulum action of the holding down bolts will cease forthwith.

When using an independent chuck on work of same size, as when cutting up the shafting in the method described in this paper, the same chuck jaw should be moved after the first piece has been trued up.

This will avoid unnecessary adjustment and save time. The chuck jaws and grooves are numbered and the same figure can be adhered to closely. Should the figures not be any too prominent, chalk or crayon treatment may be added with advantage.

It will be noted that cast iron bushings are advised for use in the follow rest. The writer calls to mind a case where some long square threaded screws were to be cut with the aid of a similar device. Steel bushings were deemed advisable for such rigorous service. The bushings were made, carefully hardened and polished, and put into use, but were not so satisfactory as the much more easily worked cast iron, and, of course, the former were discarded. The writer does not wish to be understood as being on the side of cast iron as wearing better than hardened steel under all circumstances. Plain cast iron has remarkable wearing qualities, ample at any rate in combination with the price to supersede steel for the purpose named.

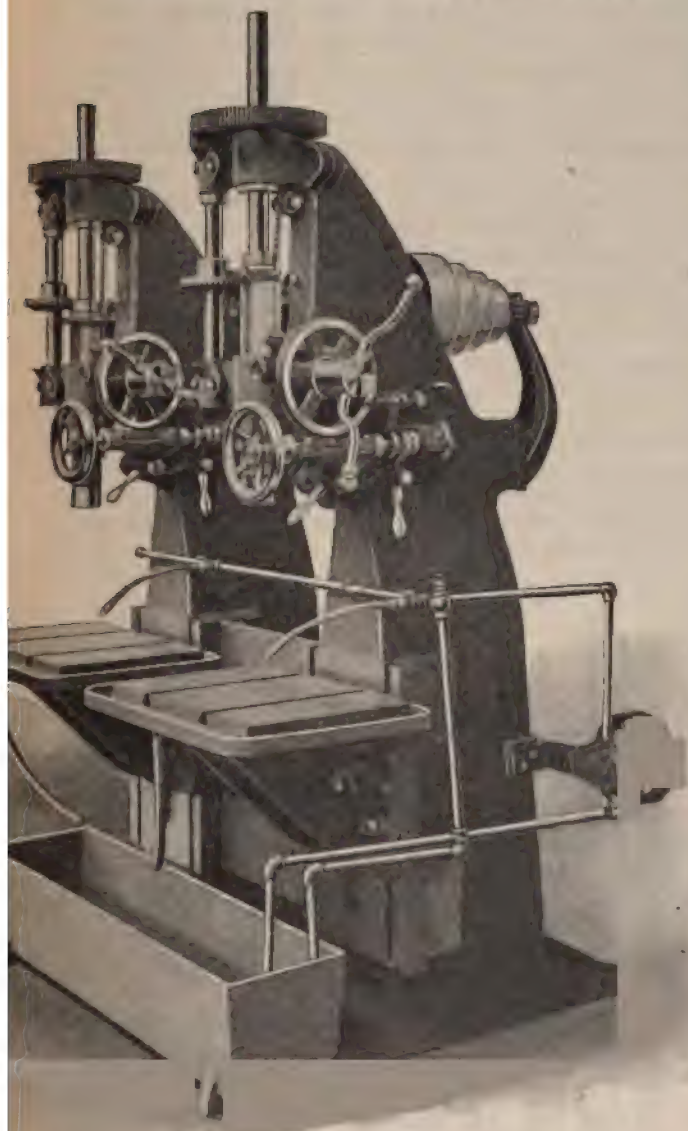
Heavy Multiple Drill and Boring Machines.

We illustrate herewith a heavy multiple drill press or boring machine built by Baker Brothers, of Toledo, O. The machines shown in the cut are designed especially for drilling, facing, boring and tapping all classes of work where the pieces to be machined are not large, yet require the removal of a considerable amount of metal. They are particularly adapted for manufacturing parts of vehicle motors, etc.

These machines are made in the form of drill presses, like those shown in the cut, and are also made as small boring mills with a revolving lower spindle, carrying a chuck or face plate for holding the pieces to be machined. The illustration shows a two-spindle drill, each spindle being a separate machine yoked together to form a gang. Any number of machines can be yoked together in this manner. The main frame is all made in one piece, and cored out. Its shape and construction are such that no springing can take place, thereby reducing to a minimum the danger of breaking drills and insuring great accuracy in drilling. The following special features are combined: Power self feed, hand worm feed, automatic stop and quick return for spindle. The arrangement of parts is such that any of these feeds can be used independently of the others and with the greatest ease on the part of the operator. The mechanism is very heavy, the worm

gear being of steel and being driven by a steel worm running in oil. The spindle is heavily back-geared, has four changes of speed and three changes of feed for each spindle speed, is fitted with hardened tool steel ball-thrust bearings and is counterbalanced. The tables are of the bracket form and are very massive, making springing impossible. A special pump is furnished, fitted and connected with each gang of drills, and the machines are piped for conveying the lubricant to the drills or cutters. We have only described one type of drill in this article, but the manufacturers are building quite a variety of this special class of machinery, all different from any other drills on the market. The general construction is similar so far as the shape of the frame, etc., is concerned, but they are built for widely different purposes. Most of the machines are adapted to be ganged together by means of brackets, thus making it convenient to run a number of machines in a gang.

A gang of fifteen of these machines has recently been sold to a motor vehicle manufacturer for boring cylinders.



HEAVY MULTIPLE DRILL PRESS AND BORING MACHINE.



THE COLBURN KEYWAY CUTTER.

Another machine of this firm's make, which should be of special interest to manufacturers of motor vehicles, is the Colburn Keyway Cutter. This machine is designed for cutting keyways in all kinds of work such as gears, pulleys, couplings, etc., but is also adapted for a great variety of other work such as internal slotting, cutting oil grooves and any character of work that has to be done on the inside of the bore. They are built in five sizes to cut keyways from the smallest up to the largest. One of the special features is the upper support for the cutter bar, which is in the form of an upper arm made adjustable on an upright column, so that it can be raised and lowered for the different heights of work to be key seated. The upper guide bar, which is shown detached in the cut, is adapted to be screwed on the end of the cutter bar, thus forming a practically solid bar with a support above and below. This fixture prevents any springing of the cutter bar, and the keyway can be cut with the greatest accuracy. The length of the stroke is determined by the tappets on the disk at the side of the machine. The depth of the keyway is regulated by means of a micrometer depth screw which insures any number of keyways being cut exactly the same depth, and by means of a tilting table any number of keyseats can be cut the same taper. Another special feature is its adaptability for duplicating work. All the chips falling from the cutter come out in front of the machine and do not get into any of the working parts of the machine.

These machines have had a very large sale, both in this country and abroad. Special attachments are built to go with the machines for planing keys, racks and internal slotting.

WANTED.—Vol. 1, No. 1, Vol. 2, Nos. 5, 6, 7, 8, 9, 10, and Vol. 3, No. 1. A new number of the weekly will be given in exchange for any one of these, *if in good condition*, and for Vol. 1, No. 1, four numbers will be given if in good condition. HORSELESS AGE, American Tract Society Building, Nassau and Spruce Streets, New York.

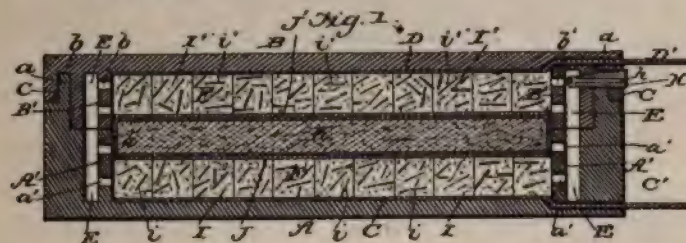
MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

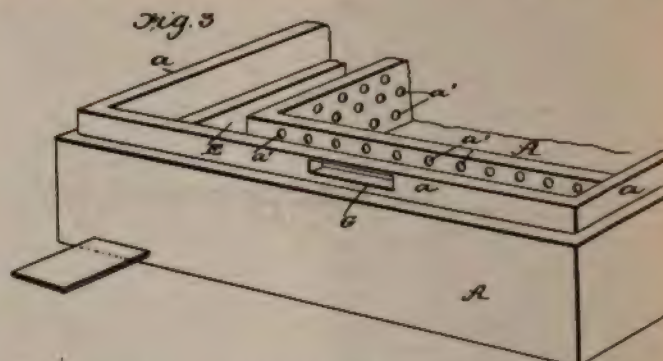
No. 630720, Dated Aug. 8, 1899—Storage Battery.—Charles Lindenberger, Harry Lindenberger and William B. Teal, of Hannibal, Mo., Assignors of One-Third to Wilbert H. Cobb, of Same Place.

The case is composed of the pan A and the cap B, which are fitted together at their meeting edges by a rabbeted joint at C, which is preferably effected by grooving the depending flange of the cap at b to receive a rib a, formed at the upper edge of the side or flange of the base-pan A, as is best shown in Fig. 1. While the case may be made of any suitable material, it is preferred to form its sections A and B of hard rubber and to receive the battery plates C and D, the former resting upon the upper side of the bottom of the pan and the latter against the under side of the top of the pan, such plates C and D being extended through and beyond the upright walls of their respective supports, the extensions C' and D' forming the terminals or binding posts, and such extensions where they pass through the walls of their supports being vulcanized to form a tight joint.



The sections A and B are provided with inwardly projecting plates A' and B', which are continuous and are spaced apart from the inner faces of the sides of said sections, thus forming the chamber E for the circulation of the electrolyte. The plates A' and B' meet at their inner edges, and these plates are perforated at a and b for the passage of the electrolyte from the chamber E to the active elements contained in the chamber F within the space inclosed by the plates A' and B'. In practice the battery elements may be placed in the pan and in the inverted cap, the parts refitted together, and the electrolyte be supplied to the chamber E through the opening G, formed through the upright rim of the pan. This opening G may incline downward toward its inner end and is normally closed by the plug H. This plug is tapered to fit the opening G and is provided with the vent openings h, which have the upright branches h' and the outwardly inclined branches h².

As before suggested, the lead battery plates C and D are secured permanently within the battery case, and in practice the active elements, positive and negative, rest against their respective battery plates without being secured thereto. This permits the renewal of the said elements without necessitating the removal or displacement of the plates, and thus simplifies the construction and renders the operation of renewing the battery quite convenient.



The battery elements are preferably formed of small blocks or cubes, which lie against the battery plates and may be formed to fit within the chamber F, and thus aid in simplifying the renewal of the battery. In practice we make the positive and negative blocks I and I' alike and embed promiscuously therein lead wires or strips i and i', leading to the surface of the blocks. It should be understood, however, that these blocks are of material suitable to form the positive and negative elements, the positive element I being of red lead and the element I' of litharge. Next to the inner faces of the blocks I I' we provide sheets J J', of asbestos paper, between which is a pad K, of charcoal and bibulous paper.

In operation when the battery is properly charged with the elements I I' the electrolyte may be supplied through the opening G, and will then circulate within the chamber E and through the openings a' b' into contact with the active elements, which by the cube or block construction afford a large surface for the action of the electrolyte.

No. 630753, Dated Aug. 8, 1899—Storage Battery—William Henry Smith, of London, England.

a b are the two channeled or corrugated sheets of perforated celluloid, ebonite or other suitable material, which are made with narrow grooves or channels c on the outer side and with wide grooves or channels d on the inner side thereof and which form the two halves of a retaining envelop for inclosing the active material.

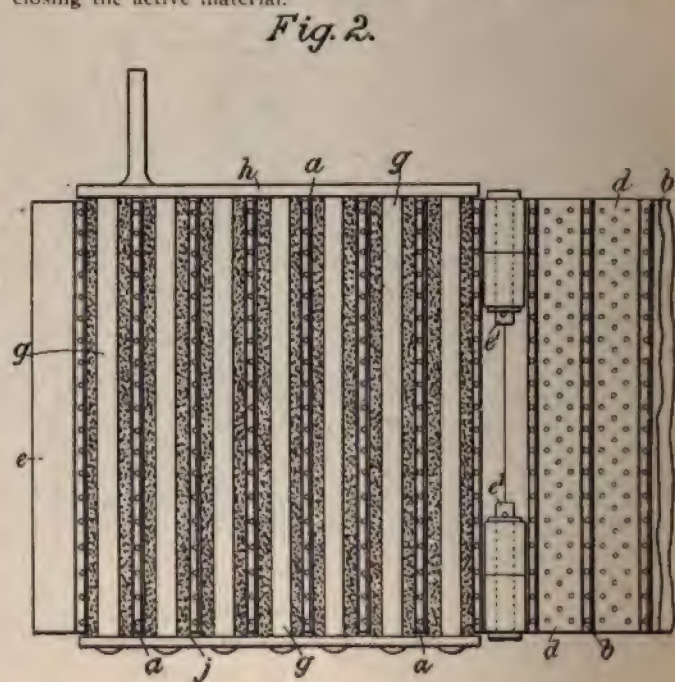
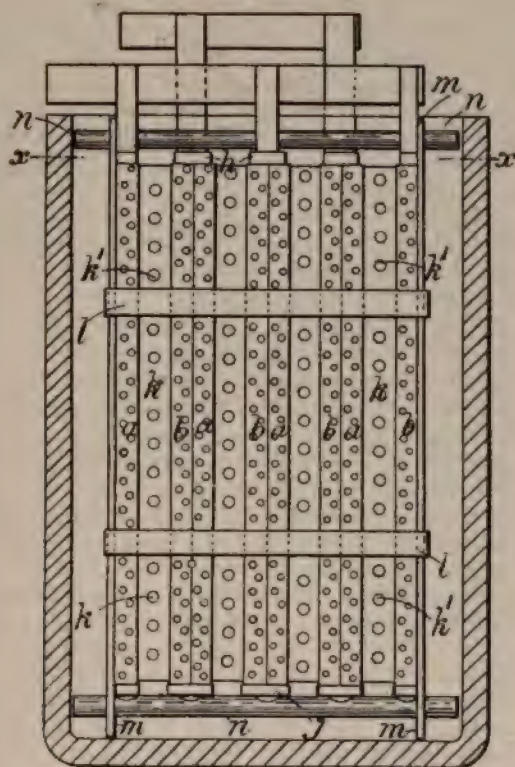


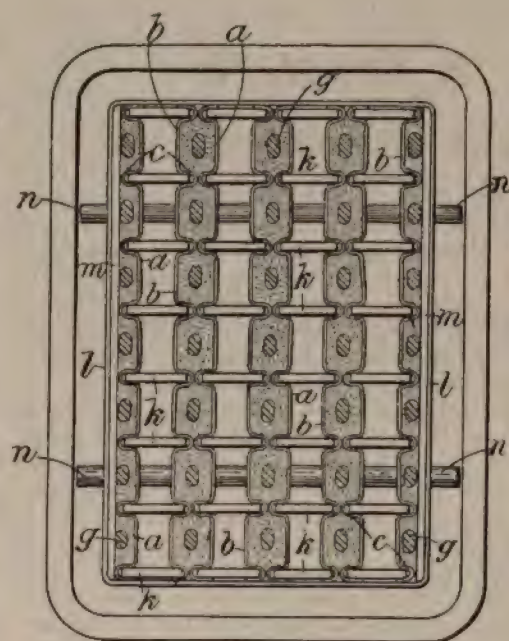
Fig. 5.



e e are the temporary supports for the two corrugated sheets or molds *a b*, which supports are provided with a series of projecting strips *f*, and are preferably connected by hinge joints, as at *e'*, so that one can be folded over upon the other, as indicated by the dotted lines in Fig. 1, or other suitable means are provided for facilitating the placing of one sheet or mold in its correct position upon the other. One of the said sheets *a b* is placed on the flat or plane surface of each of the supports *e*, so that the projecting strips *f* thereof enter the narrow grooves *c* of the said sheet. These projecting strips serve to keep the grooves *c* free from active material and at the same time prevent flattening out of the corrugated sheet while being filled. The wide grooves or channels *d* of the sheets or molds *a b* are then filled with oxid of lead or other suitable active material until the same is level with the top of the said channels. Then while the active material is still in a plastic condition the rods or cores *g*, of lead or other suitable conducting material, are laid on the active material in one-half of the retaining envelop, so that these rods are parallel with and in the center or about the center of the wide channels *d* of the said sheet. The other half of the retaining envelop is then placed on the top, so that its active material is in contact with the said rods or cores and so that the grooves or channels are directly opposite each other. The two halves of the plate or electrode thus formed are then pressed together until the active material therein is in contact, the conducting rods or cores being at the same time forced into the active material so that they are embedded therein. The electrode is then removed from the temporary supports *e*.

The two halves of each perforated retaining envelop are sometimes secured together at their edges—for example, by

Fig. 6.



folded pieces *p* of celluloid, ebonite or the like slid over the said edges.

The electrodes are preferably so constructed that their grooves or corrugations extend vertically, as shown. The conducting rods or cores *g* are formed on or attached to a conducting bar *h*, extending along the top of the electrode, and a bottom plate or bar *j*, of ebonite, lead or other suitable material, is secured to the lower ends of the said rods or cores *g*, so as to prevent falling of the active material from between the aforesaid corrugated sheets or molds.

In some instances, in order to still further lighten the plates or electrodes, the bottom bar *j* is made thinner, and a folded piece *q*, of celluloid or other suitable material, is cemented or otherwise secured upon the lower edge of the plate or electrode. I find it advantageous also to secure the inner ridges of the corrugations of one-half of the retaining envelop to those of the other by means of cement or other suitable material or by partially dissolving the celluloid at these parts and causing them to adhere together.

In the accumulator shown in Figs. 5 and 6 the electrodes are kept in position at a suitable distance apart by perforated strips *k*, of ebonite or other suitable non-conducting material, which fit into the narrow external grooves *c* of the corrugated sheets *a b* and serve as struts to effectually prevent bulging of the retaining envelops, even when the latter are made of very thin and light perforated sheets of celluloid. The several electrodes are held together, with the separating strips *k* between them, by means of elastic bands *l*, placed around the series of electrodes. I find it advantageous to provide at each end of the series of electrodes retaining bars or plates *m* and to pass through these bars or plates suitable rods *n*, some of which extend beneath and others above the said electrodes.

The said bars or plates *m* at one or both ends of the series are left free to slide upon the said rods *n*, so as to permit expansion and contraction of the active material. The said separating strips, in conjunction with the said elastic bands and the end plates *m* and rods *n*, serve to retain the two halves *a b* of the several electrodes in their proper relative position and also to keep the active material in close contact with the conducting rods or cores, while permitting and compensating for the expansion and contraction of the said active material without distortion of the electrodes.

I prefer to make the electrode at either end of the series of a single perforated sheet or mold *a* or *b*, filled with active material, in which conducting rods *g* are embedded, the outer surface of each sheet being preferably covered by perforated plates of celluloid, ebonite or other suitable material.

No. 630714, Dated Aug. 8, 1899—Storage Battery.—Charles W. Kennedy, of Rutledge, Pa., Assignor, by Mesne Assignments, to the Electric Power Development Co.

A A' A² A³ indicate a series of cells, trays or cups constructed with my improvements. Each of these is a counterpart of the other and is formed with the upper flaring portion *B* and also the bottom portion *B'*. The upper part *B* is formed of thin hard rubber or suitable insulating material, and the walls thereof are flared in substantially the way shown, so as to provide for the nesting of one cell within another.

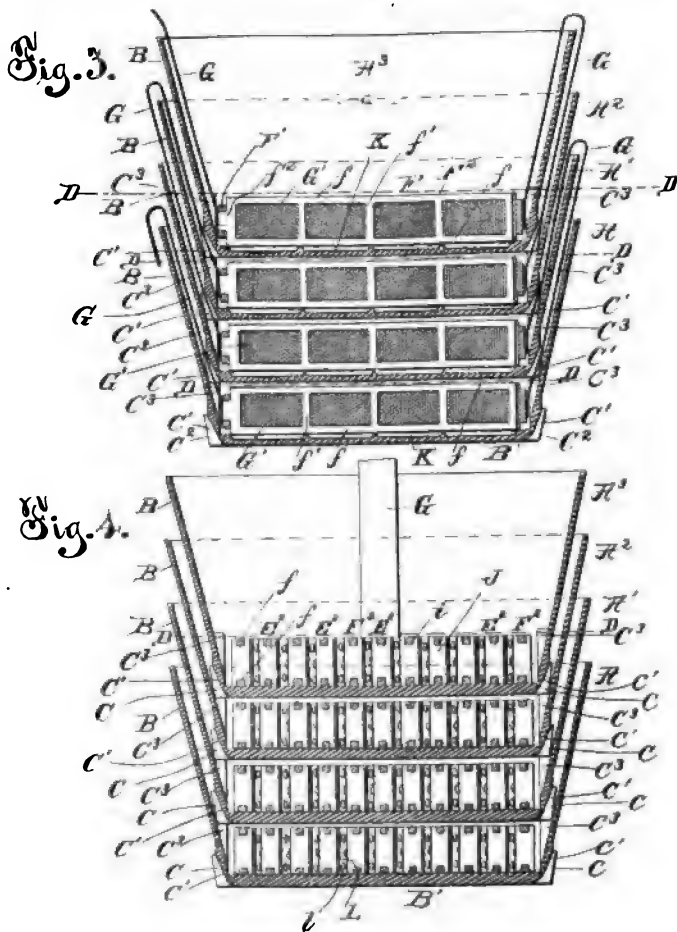
Among the objects of the invention is this, namely, to provide a series of superposed nested cells which shall be of minimum weight and maximum power, which shall have the

active material all on the central vertical lines of the battery, which shall permit the bottom portion of one cell to rest directly upon the bottom portion of another, so that the upper parts of the cell can be thin and light and not be required to sustain any of the weight and be out of contact with each other to prevent possibility of short-circuiting, and which shall have horizontally disposed electrodes with all of the parts of each in relatively low planes, so that a shallow body of electrolyte can be employed. To accomplish some of these objects, the cells are shaped in the way shown. Below the upper wider flared part *B* of each there is the aforesaid shallow bottom portion *B'*, the walls of which are thicker or heavier in places, at least, than are those of the upper flared part, and the sides are vertical or approximately vertical.

The bottom portion *B'* of each cell has outwardly extending projections or thickened sections, as shown at *C*. Preferably there is one of these at each corner and outside thereof for purposes to be described. Between these there are one or more open passageways at *C'*. A passageway or opening can be provided extending from one of the outside corner projections to the other, or a series of such passageways can be provided with intervening lugs or extensions *C''*. These are open and do not extend above the strong base part *B'* of each cell. Then upon the inside of the cell there are a series of inner projecting lugs or thickened parts at *C''*. They preferably correspond in position to the outer extensions *C*, though their tops are in or near the top plane of the base part *B'*. By examining the drawings it will be seen that when the cells are constructed with these features they can be readily superposed and nested one within the other, that at *A'* fitting within that of *A* and having its exterior lugs or thickened parts *C* fitting in or resting upon the interior lugs or shoulders *C''* of the outer cell.

The positive and the negative electrodes are substantially similar to each other and are formed as follows: Each has a cross plate or bar and a series of finger-like bars projecting laterally therefrom. The positive electrode is indicated as a whole by *E*, its cross connecting bar by *E'*, and its lateral-extending bars or fingers by *E''*. The negative electrode is indicated as a whole by *F*, its cross bar being shown at *F'* and its lateral-projecting bars or fingers at *F''*. These electrodes are arranged as couples, there being a positive and a negative in the bottom part *B'* of each of the trays or cells. The fingers or bars *E'' F''* interlap or lie parallel to each other, all being horizontally disposed. Consequently they can be covered by or submerged in a shallow mass of electrolyte and yet be able to absorb and return a powerful current. When looked upon in plain view the fingers or bars *E''* of the positive electrode each lie between two of the fingers or bars *F''* of the negative.

Each electrode has its fingers or bars *F''* formed as a thin elongated frame piece—that is to say, with a top bar *f*, a bottom bar *f'*, and a series of vertical crossbars *f''*. At *f'* it has a lug or extension by which it can be secured to a cross bar *F'*. Between the bars of this frame piece there are apertures or large openings, as will be seen. In these openings I apply the principal part of the active material, the bodies thereof being shown at *G'*. These bodies or masses are built up of pieces of lead tape. The smooth lead tape *H*, Fig. 6, is first provided with indentations by passing it between suitably shaped rollers, the active faces of which rollers have suitable projections for imparting the desired shape to the lead. Ordinarily I employ rollers, to the faces of which emery, corundum or other suitable material is applied, it being adapted to form a large number of minute but strongly pronounced indentations which enlarge greatly the exposed and active surface of the lead.



After the lead has been prepared in this way it is cut into lengths J. These short sections of the tape are provided at each end with a slot or groove i. This can be done by the cutter which severs the sections from the tape, or a number of the sections can be secured together in a block-like mass and then the grooves can be cut by any suitable tool. After the sections J have been thus formed they are inserted into the bars or frame pieces F'. Each is held by having its slot i arranged to receive the bars f f. The opening in the bars F' is packed with as many of these sections as are necessary, allowance being made for expansion.

I form in the bottom of the cell a series of pockets or cavities K, either by making depressions in the castings or by forming ribs extending up from the bottom wall. The electrodes E F rest upon these and any materials dropping will fall entirely below the bottom of the electrodes.

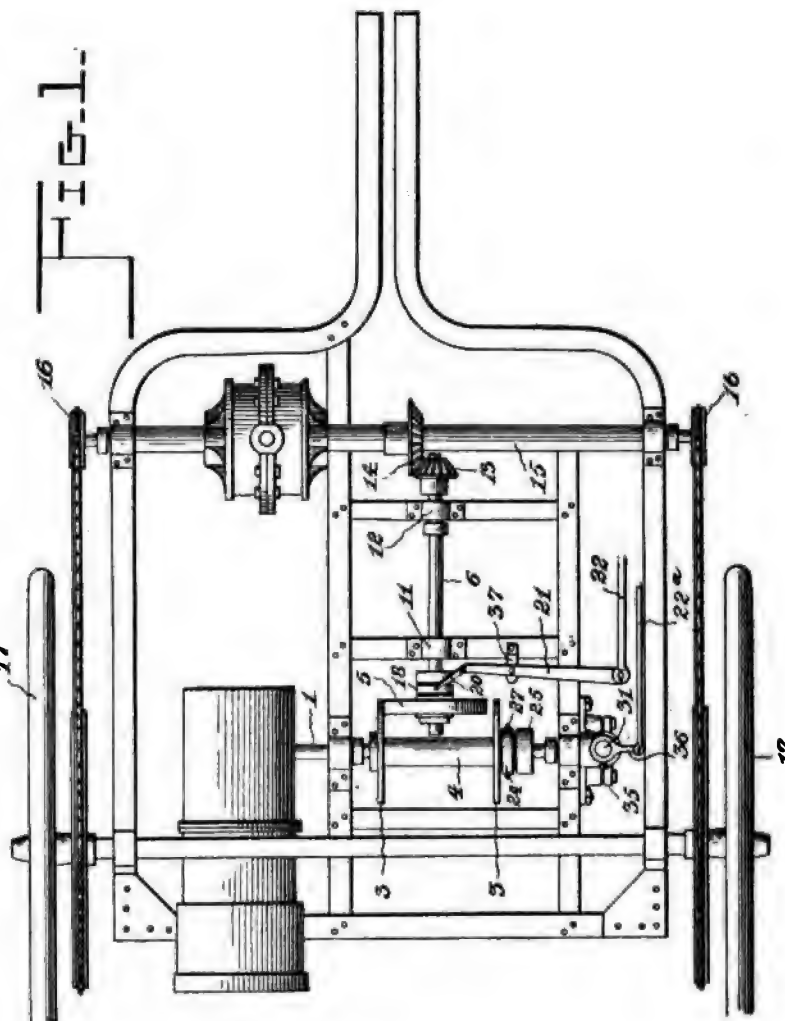
No. 630471. Dated Aug. 8, 1899—Reversing Gear for Motor Vehicles.—Frank Stutzman, of Williamsport, Pa.

1 designates a transverse drive or motor shaft designed to be connected with the motor of a vehicle; but the reversing gear may be employed on any other machine, and the said drive or motor shaft has a pair of friction wheels 3 splined on it and connected by a hub or sleeve 4 and adapted to engage alternately with an adjustable friction gear or pinion 5, whereby a longitudinal shaft 6, upon which the friction gear or pinion is mounted, may be driven in either direction. The friction gear or pinion 5 is provided on the interior of its hub with a groove 8, which receives a feather or spline 7, extending longitudinally of the shaft 6, and the said gear or pinion 5 is capable of movement longitudinally of the said shaft to arrange it at different distances from the center of the friction wheels, whereby the speed of the longitudinal shaft may be varied without changing that of the drive or motor shaft. The friction gear or pinion 5 is caused to mesh or engage either of the friction wheels 3 by shifting the latter transversely of the vehicle, and the friction wheel is provided with a groove 9 to receive the feather or spline 10 of the motor shaft.

The longitudinal shaft 6 is journaled in suitable bearings 11 and 12, the bearing 11 being preferably provided with anti-friction rolls to relieve the parts of friction resulting from the lateral thrust incident to the frictional engagement of the wheels 3 and the gear or pinion 5. The front end of the longitudinal shaft is connected by bevel gears 13 and 14 with a transverse shaft 15, journaled in suitable bearings and connected by sprocket gearing 16 with the hind wheels 17 of the vehicle.

The adjustable friction gear or pinion 5 is provided with a ball-bearing collar 18, having annular series of antifriction balls arranged at its edges, and it is connected with a yoke 20 of a lever 21, fulcrumed between its ends and extending outward from the longitudinal shaft to one side of the vehicle and connected at its outer end by a rod 22 with a suitable operating lever, by means of which the friction gear or pinion 5 is adjusted.

One of the friction wheels 3 has a hub extension 23, on which is mounted a ball-bearing collar 24, similar to that before described, and having annular series of antifriction balls interposed between its edges and the adjacent friction wheel 3, and a fixed collar 25, arranged on the outer end of the hub extension, and the balls 26 enable the friction wheels to be shifted frictionlessly. The ball-bearing collar 24 is connected with a yoke 27 of a connecting bar 28, disposed transversely of the vehicle and having its outer end bifurcated or forked and provided at the sides of the fork or bifurcation with



similar loops formed by openings 29. Within the fork or bifurcation of the transverse connecting bar is arranged a cam 30, mounted on a reversing shaft 31 and interposed between a pair of springs 32, extending across the fork or bifurcation and supported by the openings of the sides thereof. The terminals of the springs are bent at right angles to form portions 33 for engaging the outer faces of the sides of the connecting bar, and these springs engage the cam with sufficient force to lock the reversing gear in either position, thereby obviating the necessity of employing ratchet mechanism or analogous devices which have to be manipulated by hand independently of the reversing shaft. The cam is provided at its lower end or face with an annular flange 34, forming a disk to engage the lower face of the forked portion of the connecting bar, and the adjacent faces of the connecting bar and the disk or flange are recessed or rabbeted to provide an interlocking connection for preventing the parts from sliding on each other laterally of the connecting bar and to form a guide for the latter in its longitudinal shifting movement.

The reversing shaft is journaled in a sectional bearing 35, and it is provided at its upper end with a crank or lever 36, which is connected by a rod 22a with suitable operating mechanism. In operating the reversing shaft it is only necessary to shift the crank or lever, and the locking device will

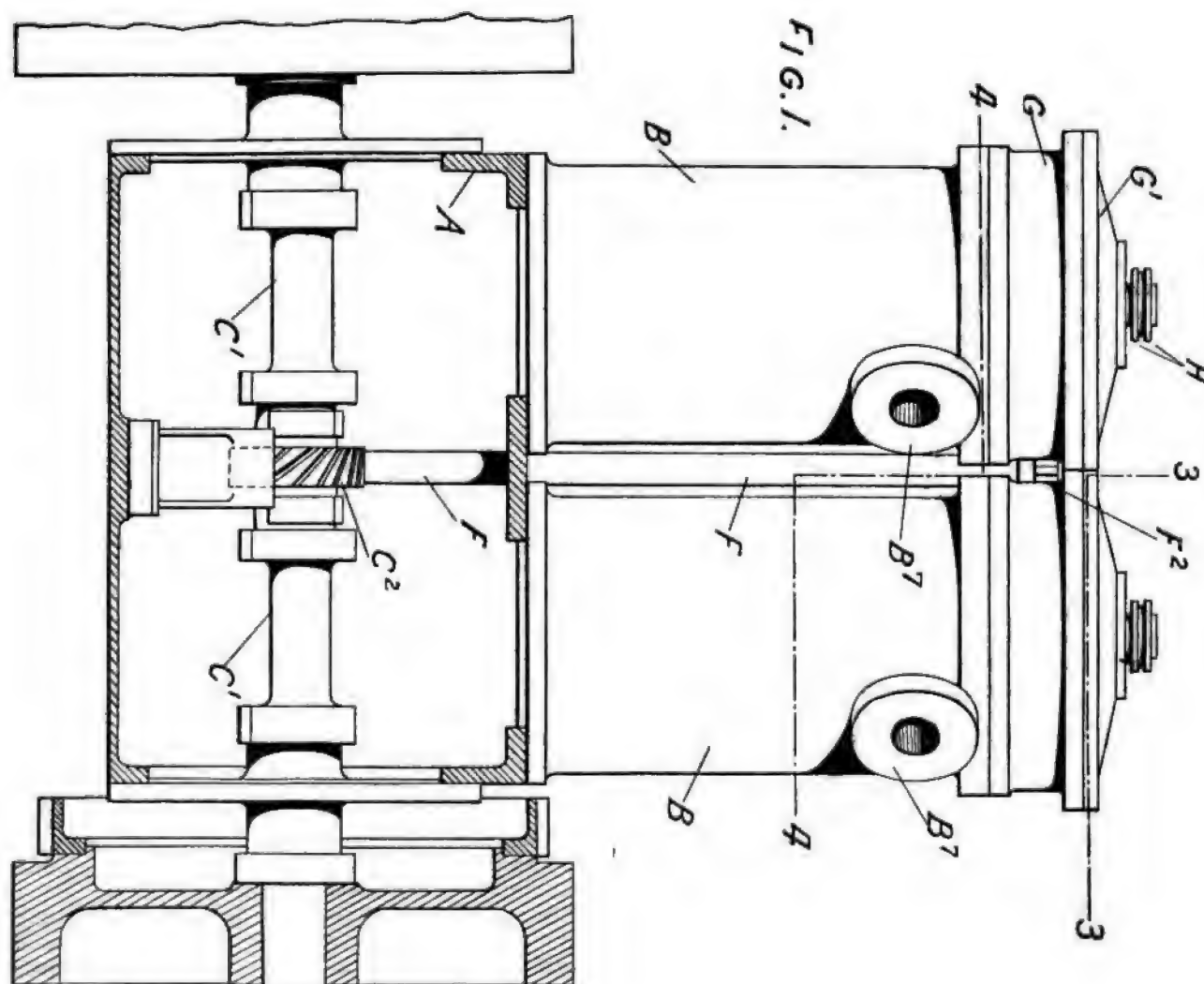
automatically engage the cam and retain the friction gear or pinion in engagement with either of the friction wheels.

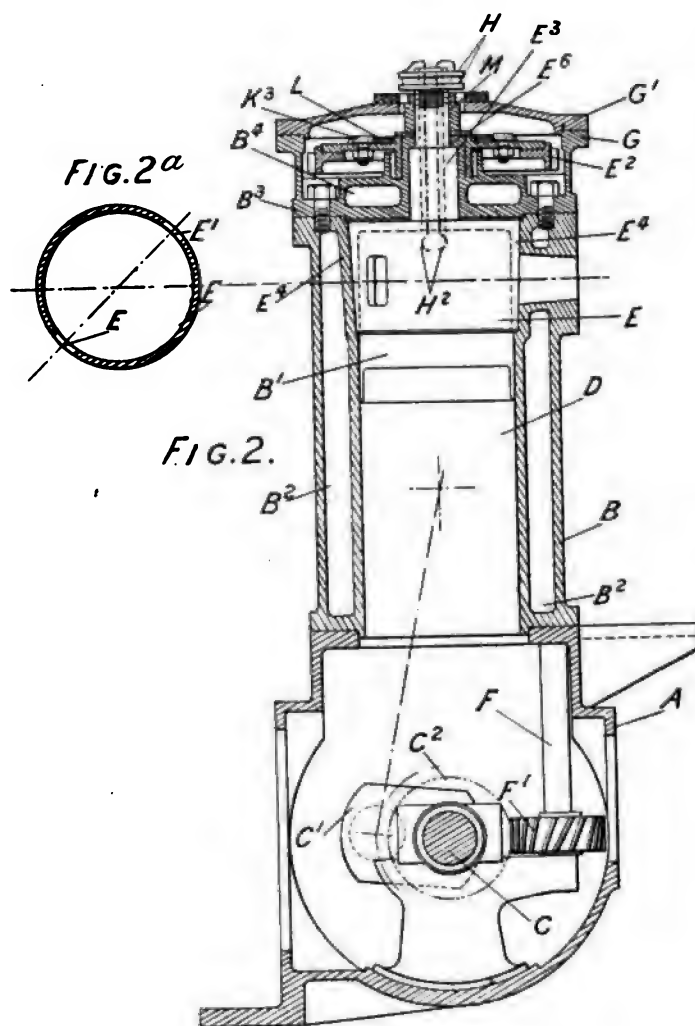
The lever 21, which has the yoke 20 at its inner end, is fulcrumed on a short oscillating link 37, which permits the lever to move inward and outward to adjust itself to the position of the friction gear or pinion.

No. 630057, Dated Aug. 1, 1899—Valve and Valve Gearing for Explosion Engines.—Charles M. Johnson, of New York, N. Y.

A is a base or bed plate, upon which are mounted two water-jacketed cylinders B, of which B' is the steam or fluid space and B² the space for the cooling water. The crank shaft is shown at C and the cranks at C', the connecting rods being omitted for the sake of clearness. The trunk piston is shown at D and the cup-shaped valve hereinbefore referred to at E. The crank shaft C drives the valve E by means of toothed gearing, C², F' F' being a toothed wheel mounted upon a vertical shaft F, which drives the valve by means of toothed gearing F² E², E² being a spur ring attached to the valve stem E³. The outer surface of the valve E is made conical, as seen at E⁴, and the cylinder is bored out at that part so as to

form a seating for the valve. Provision is made in the cylinder head B² for water-jacketing it by means of water circulating through the spaces B⁴. The spur ring E² is attached to the valve stem E³ by a device which will be hereinafter more particularly described and is, together with this device, inclosed within a casing G and cover G', so as to exclude dirt. The upper extreme of the valve stem E³ carries two contact rings H, upon which brushes H' press, so as to make electrical contact therewith, the charge within the cylinder being fired electrically by means of wires H², passing through the valve stem and connected to the said rings H. The spur ring E² is attached to a wheel K by means of bolts K' passing through slots K² in the wheel. Other bolts K² serve to drive a disk L, the bolts K² engaging slots L' in the periphery of the disk L, so as to allow the latter to move along the line connecting the centers of the bolts K² relatively to the wheel K, but not allowing it to move in a direction at right angles to this. Other slots L² in the said disk engage the downwardly extending portions M' of a double arm M, the arm M being connected to the valve stem. To avoid the possibility of the portions M' of the arm M engaging with the disk K, large slots K⁴ are





formed therein below the slots L^2 , so as to allow the portion M' to have a certain amount of play therein even in the event of their projecting sufficiently low to enter the slots K^4 . This device enables the valve to be driven by means of the spur ring E' , even provided the valve stem E^2 should not be exactly central within the ring, and serves, broadly, to allow of certain errors in the adjustment of the ring E^2 in regard to the valve stem without causing any side stresses upon the valve stem E^2 or conical valve E . The slotted holes K^2 in the wheel K permit of a fine adjustment of the ring E^2 relatively to the wheel K , and thus afford a means of adjusting the position of the valve ports E' relatively to the position of the cranks when the adjustment of one tooth of the spur gearing either at the top or bottom of the shaft F would be too coarse.

No. 629,325.—Secondary Battery.—Ralph Ashley, of Port Republic, New Jersey, Assignor, by Mesne Assignments, to the Electric Power Development Company. Application filed July 25, 1899.

One indicates one of the cells or trays. Each of these is rectangular in form and is composed of hard rubber or other suitable insulating material with end walls, side walls and a bottom, all integral. Along the exterior corners of the bottom and the top there are grooves, as at 2, forming shoulders 3, which permit the cells to be fitted one on top of another and hold them properly in place.

Four indicates the positive electrode and 5 the negative. Each electrode comprises an end bar 9 and a series of arm-like or finger-like bars or frame-pieces extending laterally from the end bar, together with masses of active material supported therein. Each arm-like frame has one or more openings. In each opening there are loosely packed a number of metal plates 7, formed from lead tape or strips and roughened by passing them between emery-wheels or the like to form a very large number of minute indentations therein, and then subjected to the action of nitric acid to "form" them or render them active. Each plate is formed with a notch 8 at each end, in which notches lie the bars of the supporting-frame. The plates are closely and yet loosely packed in their retaining-openings and placed with the faces of each directly contacting with the faces of those adjacent, so that there is a great extending of the total active surface. When each set or mass of the plates is initially introduced into its opening 6, a space is left at the end of the opening; but as soon as the electrode is "formed" by electrolytic action the series of plates are forced by their expansion so as to occupy the entire space.

The frame-bars are relatively narrow and thin, but solid and strong, while the plates of active material are relatively considerably wider—that is to say, there is a reduction to the minimum of the solid and less permeable metal and, on the contrary, an increase in the maximum of the lighter thinner active material.

Each negative electrode is fastened at one end to the under side of a cell-bottom by means of the conductor-strip 14, which passes up from the end bar 9 on the under side of the cell through the bottom and into the interior and is secured to the positive electrode upon the upper side of said bottom and at the other end is fastened by means of supporting-strips 10 10, of any suitable number, secured to the ends of its arms and extending upward through the cell-bottom and secured to the vertical side wall of the cell by pins 13. The several arms of the negative electrode are held to the tray-bottom on such transverse lines that when it is put in position upon a tray or cell below these arms will drop down into position between the arms of the positive electrode for the purpose above described. At 12 12 there are channels or ducts of any suitable number along one of the vertical walls of the cell, and at 15 one or more similar ducts are formed along the opposite wall. These channels are closed, except at their upper ends, against communication with the interior chamber of the cell. Their lower ends open at the under side of the cell-bottom. They are of such length vertically that their upper ends lie at or above the top surface of the electrolyte material. Each channel 15 receives one of the conductors 14 and each of the channels 12 receives one of the supporting-strips 10, and in both cases the walls of the channels surround the conductors or metal strips and normally prevent contact of the liquid with the latter.

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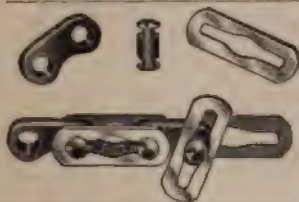
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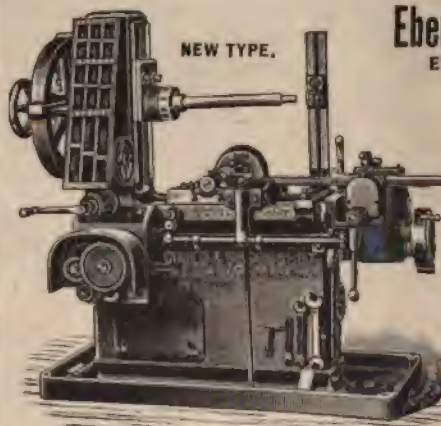
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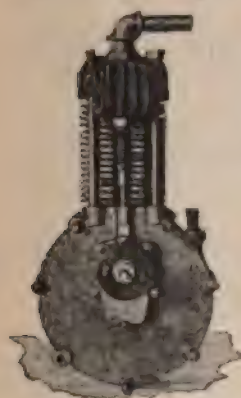
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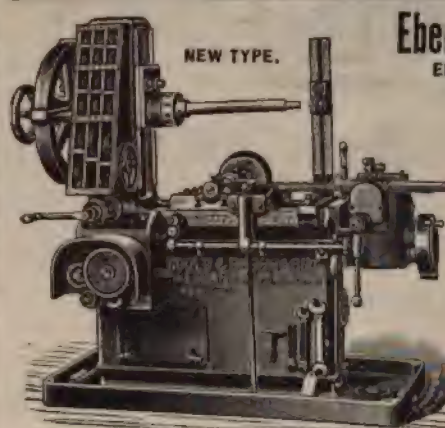
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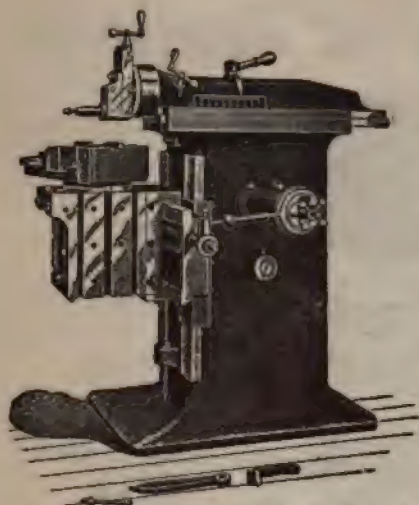
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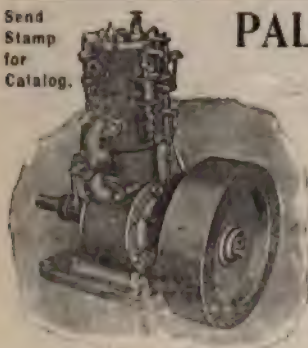
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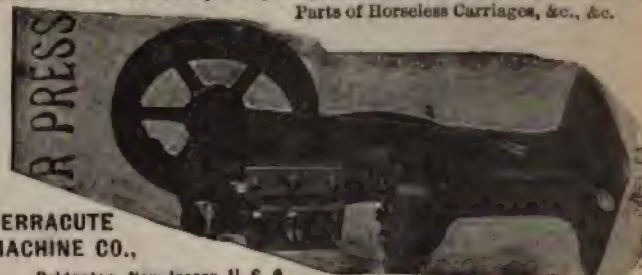
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HORSELESS AGE.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS

VOL. IV.

NEW YORK, AUGUST 30, 1899.

No. 22.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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The Shadowy Gasoline Vehicle Trust.

In harmony with the imperialistic tendencies of the day, the promoters have been forming into trusts and combinations about all the existing industries in the United States. Sighing for new trades to conquer they are casting their eyes toward the gasoline vehicle industry, which is destined to make a phenomenal development here in the next decade. Rumors of an attempt to combine the American manufacturers of gasoline vehicles have been in circulation for some time, emanating chiefly from the corridors of a fashionable New York hotel where many real and imaginary trusts have been hatched out during the past six months. The latest phase of this new promotion scheme appeared in the daily press last week, when it was positively stated that a trust to control the gasoline vehicle industry of Europe and America had been organized at the above hotel, with a capital of \$10,000,000, and four prominent American companies were mentioned as having

joined the combination, which would then own all the valuable patents, etc. To be sure the companies named were not aware their business had been quietly appropriated in this manner, but this makes no difference to the class of promoters whose chief occupation it is to furnish "fake" news to the daily press.

For once, at least, the promoters who dreamed this pleasing little dream were modest. The valuation they have set upon the hydrocarbon motor vehicle industry of Europe and America is in such strong contrast with the high water mark of the electric vehicle promoters that it is evident these wily gentlemen are losing some of the boldness which characterized their operations early in the present year. Perhaps they have been found out.

But whether the valuation set by these schemers on the hydrocarbon vehicle industry be high or low is a matter of utter indifference. The proposition they make is too absurd to be seriously considered. The claim that by any amalgamation of patents the gasoline motor vehicle industry can be monopolized is one which should be discountenanced, discouraged and exposed.

Glance for a moment at the condition of the industry in France. There at the end of a decade of progress we find a most flourishing state of things, inventive and commercial activity combining to improve and perfect the present models each passing day. New motors, new ideas in transmission and new vehicles are appearing constantly; and for every good and lasting thing there is a ready market and a liberal profit. No one in France has undertaken to monopolize the gasoline motor industry, because nobody wishes to be made a laughing stock. French investors know well that basic patents on gasoline vehicle motors cannot be procured; that to the variations in the details of transmission there is practically no limit, and that in front of any company which might boast of such a monopoly opposition would spring up like the heads of the Hydra, from which two grew out for every one that was stricken off. Even the wealth of the Rothschilds would soon

be exhausted in the attempt to buy up the competition arising from thousands of inventive minds. The tone of the whole motor movement there is, and has been from the beginning, dignified and businesslike. The French, to their credit be it said, are not engaged in stock-jobbing operations, but in building up a permanent industry.

In England the attempt of the British Motor Co. to control the industry in that country and the colonies is ending in dismal failure. The sweeping claims made by them have been disproved by the appearance of many inventions infringing in no way on their patents. The exact nature of the patents to which they ascribe monopolistic virtue has never been divulged by these dealers in mystery, and curiosity is becoming so keen on that point that it will probably not be long before the British Motor Co. will be compelled to defend its rights and submit to the courts the question of determining just what it can lay claim to in the way of valid patents. Meantime parties who have taken out licenses from them are experimenting on their own account, and devising improvements in detail which they in turn will patent and thus soon be enabled to throw off entirely the yoke of the motor syndicate. The monopoly patent syndicate will stand still; the independent manufacturers will move on, and it will not be long before they will be so far apart that the British Motor Co.'s patents will be like fossil remains in a living age.

From reliable sources, however, it is evident that a number of American capitalists of very different caliber from the romancers above mentioned, men who have large means at their disposal, have a hankering after the gasoline vehicle industry, and imagine that by a purchase of about all the patents in sight here they can secure control of the enormous business which is destined to develop in that branch.

But however great the resources these capitalists have at command, they apparently fail to appreciate the difference between a track and a common road; the utter lack of basic patents on the steam and hydrocarbon motors which are destined to do the major part of the work; the tremendous energy of the movement leading to a fertility of invention and an enlistment of capital never before equaled, and the universality of the demand affording ample scope for the profitable employment of capital, mechanical genius and commercial faculty of the highest order.

No one power can do the work; no two can do it all, and if by the force of combination anything approaching a monopoly in one motive power should be effected, other motive powers would speedily level the oppressor's claims. As to motors and transmissions, their name is legion. The possible permutations and combinations in the successful application of power to road vehicles are virtually without bounds. The amount of money which would be required to protect the monopoly from competition the first two years would be so great as to literally swamp the enterprise, for the ablest competitors would not sell out, and of the patents and business bought out most would

be worthless or of little value. As the inflated bubble grew to the bursting point, legitimate enterprise would wax strong beside it.

Of course the original promoters of this ambitious scheme would be careful to secure their profits early in the game, and avoid the final catastrophe. It is also quite possible that the editor is mistaken; that the gentlemen whose names are linked with this project do know its weakness, but believe the public does not know it.

The public should inform themselves.

Scarcity of Skilled Labor.

The scarcity of experienced drivers of motor vehicles in England and France is causing great annoyance to both manufacturers and companies operating motor vehicles. The London Electrical Cab Co. gives as the reason for the discontinuance of its service inability to retain sufficient trained drivers in its employ to man the cabs. No sooner was a man well schooled in his new occupation than some private owner would appear and offer him more wages than the company could afford to pay, and the driver would immediately accept the private situation.

In the shops the same scarcity of skilled labor is found, showing that the motor vehicle has come upon the world with such suddenness that mechanics and drivers do not yet realize the opportunity that awaits them of steadier work at higher wages in this new avenue of employment.

Schools for motor drivers and mechanics should be started as soon as possible in different parts of the United States to avert to some extent at least the conditions prevailing abroad.

Wood or Wire Wheels.

As to the relative merits of wood and wire wheels for motor carriages, opinions differ. Quite a number of manufacturers who have tried both have settled upon the wood wheel as best adapted to present conditions of road, because it absorbs vibration better and will not yield so readily to lateral strains.

Another advantage which they find in the wood wheel is the ease with which it can be washed. The wire wheel is very apt to rust when water is applied to it, particularly in the threads, parts not very accessible to the drier. A very little rust in the threads will cause the spokes to pull out under stress and the whole wheel is soon weakened.

Possibly some rustless finish may be discovered, or some other form of metal wheel which will be free from these objections and at the same time be of suitable appearance to permit its use on pleasure carriages.

As roads improve some of the objections to the wire wheel will disappear.

"American Bluff."

Such are the terms in which the claims of American inventors and American promoters are described in France to-day. A shrug of the shoulder, a contemptuous ejaculation and the whole matter is dismissed as unworthy of further notice.

Nowhere else in the world have so many "fake" inventions and promotion schemes in the motor line been brought out as right here in the United States, and to-day the whole country and the honest workers in the field are suffering from the effects of the exaggeration, bluff and, in some cases, dishonesty, which have too often been associated with American motor vehicle promotion in the past.

Happily the speculators, bluffers and cranks who brought us into bad odor have been displaced by engineers and manufacturers who will show tangible results and convince our foreign friends that the American motor vehicle industry is not all bluff by any means.

Honest Horse Powers.

In line with our recent editorial remarks on fictitious horse powers, a correspondent of the Automotor in the last issue of that journal states that accurate tests reveal an actual 1.12 to 1.13 h.p. only in the nominal $1\frac{3}{4}$ h.p. De Dion motor, and the company with which he is connected, in conformity with the De Dion ratings, had decided to call their 1.89 h.p. motors $2\frac{1}{4}$ h.p. And so the foolish practice grows, one manufacturer after another following the bad example until the whole motor industry will be based on false pretences.

The correspondent then agrees with the editor of The Horseless Age in suggesting that the bore and stroke of gasoline motors be given in the catalogues of the different manufacturers so that purchasers may verify the horse-powers from known laws.

Let us have honest horse-powers now and relieve the industry of the incubus of this deception. The period of romance and of promotion is passed.

Cuban Sugar Planters Need Motor Wagons.

Motor wagons are sorely needed on the Cuban plantations to convey the sugar cane from the fields to the mills. The war has caused such a scarcity of oxen that a good sound beast is worth \$500, and enough of them cannot be obtained to move the crop. In consequence, acres of mature cane will go to waste for want of transportation facilities. A large planter of the island lately remarked to a gentleman interested in transportation at Havana that if he could procure steam wagons to bring his crop to the mill this season it would save him \$150,000. Other sugar planters of Cuba are in just as urgent need of motor wagons.

The Electric Cab Experiments.

The withdrawal of the London electric cabs, the change of the Paris electric cabs from "fiacres" to "voitures de grande remise," for which higher rates of fare are charged, the well-authenticated reports that the New York electric cab company is looking anxiously for some more economical motive power, all go to prove what might have been known without the waste of so much money—that in the present state of the storage battery art, electricity cannot compete with horses in public cab service, but is of necessity confined to luxurious use.

Information Wanted Relative to Damage Suits.

A subscriber of The Horseless Age would like all the information he can get on damage suits in which the motor vehicle is alleged as the offending cause. He has been sued, lost his case, appealed, and wants all the assistance he can get from other users of motors who have been similarly annoyed. The editor will be glad to hear from anyone who can throw light on this matter.

The big electric vehicle companies are coquetting with each other. The Electric Vehicle Co. wants the Riker Co. and the Woods Co. to come into the fold, but the Woods Co. won't and the Riker Co. won't without a large cash consideration, which up to the present time has not been offered, from which it may be inferred that the amount of available cash behind the electric vehicle "monopoly" is not so large as its many-ciphered capital stocks would indicate.

The overturning of an electric cab in Boston the other day because of the sudden deflection of one of its forward pneumatics only adds another to the many difficulties encountered in trying to solve the paradox of using pneumatic tires on 2-ton electric vehicles, or, on the other hand, sacrificing storage batteries to cobble stones and solid tires.

That Gasoline Vehicle Trust.

Rumors were circulated during the past week about a proposed combination among the gasoline motor vehicle manufacturers of this country. It was stated that the Automobile Co. of America, the Winton Motor Carriage Co., the National Motor Carriage Co., the Manhattan Oil Motor Co. and the Canda Mfg. Co. were included in the combination, and that these companies controlled patents which would enable the new "trust" to monopolize the gasoline vehicle industry of the United States.

Inquiries among the companies named brought to light the information that while promoters had called upon them a number of times in reference to such a scheme, the use of their names was entirely unauthorized and they knew nothing further about the matter.

Freight Classification of Motor Vehicles.

According to a recent ruling of the Freight Classification Committee of the Eastern Trunk Lines, motor vehicles are "subject to the same classification as other vehicles of similar class, style and description."

Working Formulas for Otto Cycle Gas Engines.

By E. J. Stoddard.

In view of the widespread interest taken in gas engine construction, it is desirable to have simple working formulas which will give results coming within the allowable variations of practice.

It will be understood that the construction of each particular engine will have an effect upon its efficiency, and that ordinarily the best mixture to be used with an engine is not that which will give the highest M. E. P.

The approximate formula for both the comparison and expansion line of the indicator diagram may be taken as

$$(1) P V^{\frac{1}{3}} = C$$

From this fundamental formula the other formulas may be derived.

If the engine is complete we generally know the volume of the combustion chamber. We reduce this to units of cylinder length by dividing it by the piston area, and call it V_1 . We know the length of the stroke, which we shall call S . The volume at the outer dead center is V_1 plus S , and will hereinafter be indicated by the letter V . The pressure at the outer dead center, say 14.7 lbs., we shall call P , and the pressure at the end of compression we shall call P_1 .

The pressure of compression is given within the limits of convenient measurement by the formula.

$$(2) P_1 = P \frac{V}{V_1} \sqrt[3]{\frac{V}{V_1}}$$

If the pressure shown by the indicator diagram is materially less than this it indicates a proportional leakage in the valves, joints or pistons.

We design an engine to develop a certain power, therefore we wish to know in advance what amount of work will be developed by a cylinder of a given dimension.

The net indicated power for working stroke is given in foot-pounds by the following equations:

$$(3) W = 110 A V \left[\left(\frac{V}{V_1} \right)^{\frac{1}{3}} - 1 \right]$$

$$(4) W = 110 A V \left[\left(\frac{P_1}{P} \right)^{\frac{1}{3}} - 1 \right]$$

These equations may be derived as follows: When the charge is taken in it is heated by being mixed with the hot residual gases of the previous stroke. It is fair to assume that the rise in temperature is proportional to the ratio of the volume of such hot gases to the volume of the charge taken in or approximately to $\frac{V_1}{V - V_1}$. If then we assume a given temperature for the outside air, say 60° or 520° absolute, and add to this the product of the above ratio by a constant that gives results corresponding to recorded data, we shall have the following formula:

$$(5) T = \frac{V_1}{V - V_1} 280 + 520$$

by which we may approximate the temperature of the charge at the commencement of compression.

If we multiply the results obtained by formula No. 5 by the cube root of the ratio of the volumes, we shall have the temperature of compression. That is

$$(6) T_1 = T \sqrt[3]{\frac{V}{V_1}}$$

In the following table, in the first column, arbitrarily selected ratios of volumes are set down and opposite these are the values of T and T_1 as calculated by equations 5 and 6:

$\frac{V_1}{V}$	T	T_1
.5	800	1008
.475	773	990
.45	749	974
.425	727	967
.4	707	955
.375	688	949
.35	671	952
.325	655	950
.3	640	954
.275	627	966
.25	613	973
.225	601	988
.2	589	1007

The average of the values in the last column is about 975, and this varies less than 5 per cent. from the extreme values.

We may therefore assume, without introducing a very great error, that the temperature of compression is constant and equal to 971.8° F. absolute.

If the mixture is rich, and conditions favorable, the temperature rises to about 3400° F. absolute upon the ignition of the charge, and the pressure rises in proportion to the absolute temperature. That is, calling the explosion pressure P_2 , we shall have

$$(7) P_2 = P_1 \frac{3400}{971.8} = P_1 3.5$$

As we assume the same law for expansion as for compression, the pressure at the end of expansion will be

$$(8) P_3 = P_2 3.5 = P_1 14.7 \times 3.5 = 51.45 \text{ absolute.}$$

The total work of compression is

$$(9) W = 3 A [P_1 V_1 - P V]$$

(A being the piston area) and of expansion, the volumes being the same as in compression,

$$(10) W_1 = 3 A [P_3 V_1 - P_2 V]$$

Substituting the values of P_2 and P_3 in 10 taken from 7 and 8 gives

$$(11) 3.5 [3 A (P_1 V_1 - P V)]$$

for the total work of expansion.

To get the net work of expansion we must subtract from the total work—the work of compression that is

$$(12) 3.5 [3 A (P_1 V_1 - P V)] - 3 A (P_1 V_1 - P V) = 2.5 [3 A (P_1 V_1 - P V)]$$

From equation No. 1 we may derive the value of P_1 in terms of $P_1 V_1$ and V_1 .

$$(13) P_1 = P \left(\frac{V}{V_1} \right)^{\frac{1}{3}}$$

which substituted in equation No. 9, gives, after reduction,

$$(14) \ 3 A [P_1 V_1 - P V] = 3 A P V \left[\left(\frac{V}{V_1} \right)^{\frac{1}{2}} - 1 \right]$$

but $P = 14.7$, about, so that the last member of equation 14 reduces to

$$44.1 A V \left[\sqrt[3]{\frac{V}{V_1}} - 1 \right]$$

Substituting this in equation No. 12 gives us finally

$$(15) \ 110.25 V \left(\sqrt[3]{\frac{V}{V_1}} - 1 \right)$$

as the net work per stroke.

It will be sufficiently accurate to call the constant 110+.

This will give results corresponding to average practice.

The explosion pressure may be taken as

$$(16) \ P_s = 51.45 \frac{V}{V_1} \sqrt[3]{\frac{V}{V_1}} \text{ (see equations 8 and 13).}$$

This will give results somewhat too high, owing to the rounding off of the upper corner of the indicator diagram by slow combustion. However, it will be near enough for the purposes of calculating the size of the connecting rod, etc.

If the length of the stroke and the ratio of the pressures are arbitrarily selected, the volume at the outer dead center may be found by the following equations:

$$(16) \ V = \frac{S}{1 - \sqrt[3]{\frac{P}{P_1}} \sqrt[3]{\frac{P}{P_1}}}$$

$$(17) \ V = \frac{S}{1 - \frac{P}{P_1} \left(\frac{P_1}{P} \right)^{\frac{1}{2}}}$$

For convenience of use with these formulas, a table of cube and fourth roots of numbers from 2, to 7.5, advancing by tenths, is as follows:

Number.	Cube Root $\sqrt[3]{}$	Fourth Root $\sqrt[4]{}$
2.	1.26	1.1891
2.1	1.281	1.2038
2.2	1.301	1.2178
2.3	1.32	1.2317
2.4	1.339	1.2446
2.5	1.357	1.2574
2.6	1.375	1.27
2.7	1.393	1.2818
2.8	1.409	1.2934
2.9	1.426	1.305
3.	1.442	1.316
3.1	1.458	1.327
3.2	1.474	1.338
3.3	1.489	1.348
3.4	1.504	1.358
3.5	1.518	1.3678
3.6	1.533	1.3773
3.7	1.547	1.387
3.8	1.561	1.396
3.9	1.574	1.4053
4.	1.587	1.4142
4.1	1.601	1.423
4.2	1.613	1.4314
4.3	1.626	1.4401
4.4	1.639	1.4484

4.5	1.651	1.4563
4.6	1.663	1.4646
4.7	1.675	1.4724
4.8	1.687	1.4802
4.9	1.699	1.488
5.	1.71	1.4953
5.1	1.721	1.5017
5.2	1.733	1.51
5.3	1.744	1.5172
5.4	1.754	1.5245
5.5	1.765	1.5313
5.6	1.776	1.5382
5.7	1.786	1.5453
5.8	1.797	1.5518
5.9	1.807	1.5585
6.	1.817	1.5625
6.1	1.827	1.5716
6.2	1.837	1.578
6.3	1.847	1.5843
6.4	1.857	1.5906
6.5	1.866	1.5969
6.6	1.876	1.6028
6.7	1.885	1.6089
6.8	1.895	1.615
6.9	1.904	1.621
7.	1.913	1.6263
7.1	1.922	1.6325
7.2	1.931	1.638
7.3	1.94	1.6438
7.4	1.949	1.6492
7.5	1.957	1.655

Gage Pressure of Charge lbs.	Ratio of Absolute Pressures $\frac{P_1}{P}$	Mean Effective Pressure Given lbs.	Mean Effective Pressure Calculated lbs.
57	4.8	64.8	76.3
49	4.27	60.3	72.6
48	4.2	53.2	71.9
32	3.133	54.8	63.3
31	3.07	57.	62.6
48	4.2	81.5	71.9
87	6.8	100.9	88.6
60	5.	91.8	77.8
51	4.4	76.	73.5
50	4.33	68.5	73.1
73	5.87	89.	83.3
Average,		74.91	75.41

Divergence of Averages,

.5

The mean effective pressure found by dividing equation No. 4 by equation No. 17 and reducing, is

$$\text{M. E. P.} = \frac{110 \left(\frac{P_1}{P} \right)^{\frac{1}{2}} - 1}{1 - \frac{P}{P_1} \left(\frac{P_1}{P} \right)^{\frac{1}{2}}}$$

DISCUSSION OF EQUATIONS NOS. 3 AND 4.

These equations would seem to indicate that the power to be got out of a cylinder of a given volume increased in proportion to the parenthetical repression $\left[\left(\frac{P_1}{P} \right)^{\frac{1}{2}} - 1 \right]$

In the entropy diagram for gas engines the area that represents the work done is very nearly proportional to the same expression. This would seem to confirm the correctness of the form of the equation.

In the following table I have taken twelve examples just as I found them in the books, mostly from Dugald Clerk on the gas engine, I believe, without any selection. In the first column I have set down the gage pressure, in the second the ratios of absolute pressures, in the third the given mean effective pressure, and in the fourth the calculated M. E. P.

A comparison of the given data shows that the results were effected by particular conditions or accidental causes. If the calculations are correct they give results following a definite law. It is noticeable how near the average of the given results and the calculated are to each other.

Very likely an empirical factor depending upon the size of the engine, or upon the kind of fuel used, or both, should be introduced into the formula. But at present I have not enough data to select such a factor or factors.

LONDON NOTES.

LIVERPOOL TRIALS BEARING FRUIT.

London Aug. 17.

The recent trials of heavy motor wagons at Liverpool are already having practical results. The Lancashire & Yorkshire Ry. Co. have acquired a Thornycroft steam wagon and trailer—the two combined being capable of carrying a load of $6\frac{1}{2}$ tons—with a view of giving the same a thorough trial. Any one acquainted with Lancashire, and particularly Manchester and Liverpool, is familiar with the fine horses owned by the L. & Y. Ry. Co. and employed in connection with Lancashire textile trades. These have done good work for years, but it would seem—in view of the success of steam wagons—that their death knell has been sounded. In addition to the railroad company, it is also stated that quite a number of mill owners in East Lancashire have as a result of the tests placed orders for heavy steam wagons for the transport of cotton and cotton goods.

THE RAGLAN GASOLINE CARRIAGE.

The popularity of the Benz carriage in England is giving rise to several new vehicles of the same type, but of English construction throughout. I have already alluded to the productions of the Star Motor Co., Ltd, of Wolverhampton, while



RAGLAN GASOLINE MOTOR CARRIAGE.

now the Raglan Cycle & Anti-Friction Ball Co., Ltd., of Raglan Works, Coventry, have just put on the market the Raglan motor carriage, carrying three persons at any speed from 6 to 16 miles an hour. The motor is of the horizontal type, arranged as in the Benz carriages, in the rear, the transmission being effected by means of belts working on fast and loose pulleys. Certain detail improvements have been effected on the motor, more particularly as regards the control of the admission and exhaust valves. A special feature claimed for the Raglan carriage is that all the parts are made on the interchangeable system, so that in case of repair and renewals the necessary part can be quickly obtained and applied. The wheels are of the suspension type, running on ball bearings and shod with solid rubber or pneumatic tires, as desired. Three brakes are provided—a band brake on the rear axle, controlled by a pedal, and shoe brakes on the rear tires, controlled by a hand lever. The carriage altogether has a neat appearance and the workmanship is of a high class.

ANOTHER BELGIAN CARRIAGE.

I send you an illustration of a new light motor carriage, known as the Rumpf, which has just been put on the market by Les Ateliers du Progrès Industriel, 14 Rue des Croisades, Brussels. The vehicle, which has seating accommodations for three persons, is of small dimensions, the builders having endeavored to produce a small vehicle with the power and rigidity of a large carriage. The motor, which is located in the front portion of the frame, is of the gasoline type, with two balanced cylinders, capable of working up to $6\frac{1}{2}$ h.p. Electric ignition is adopted, while, for cooling purposes, the cylinders are water-jacketed. Four forward speeds—8, 16, 28 and 45 kilometers per hour—and one backward motion are provided, all being controlled by a single lever. Three brakes are provided—two band brakes on the rear hubs and a band brake acting on the differential. Steering is effected by the front wheel and controlled by a hand wheel. The wheels have wooden spokes and pneumatic tires.

THE JAMES & BROWN GASOLINE CARRIAGE.

I recently inspected a new light horseless carriage, at present in course of construction at the works of James & Brown, engineers, Buckingham Palace Road, London, S. W. The motors and transmission gear are all mounted on a channel iron frame in such a way as to be readily accessible. Two 2-h.p. horizontal gasoline motors are employed, having water jacketed cylinders, and arranged for electric ignition. I was struck by the readiness with which the admission and exhaust valves could be withdrawn, while the same is true of the piston rods, notwithstanding that the cranks rotate in an oil-containing case. The transmission gear is also of an interesting type; two speeds are provided by means of chain gear and friction clutches. The motor shaft carries two sprocket wheels connected by Renold "silent" chain to similar wheels on the countershaft. Either chain, as desired, is made to drive by means of the friction clutches connected with the sprocket wheels on the motor shaft. From the countershaft to the rear axle the transmission is effected by means of a central chain drive. The wheels are of the suspension type with pneumatic tires.

MOTOR OUTINGS POPULAR.

A new and pleasant means of spending the Saturday half-holiday is springing up for the public in several parts of the country, viz., that of short afternoon trips by horseless vehicles. During the past week particulars of quite a number of such outings have reached me from Birmingham, Enfield, Clevedon

and Gravesend. In the London district, also, the owner of a motor wagonette at Wandsworth is running trips to such places as Virginia Water, Windsor, etc., while at Richmond a company is being formed with the title The Thames Valley Motor Car Co. to run a service of motor vehicles between those three popular Thames pleasure resorts—Richmond, Twickenham and Hampton Court.

PARTINIUM THE NEW ALLOY.

De Dion & Bouton are building a new steam omnibus with seating accommodations for twenty-four passengers. The feature of the vehicle is that the body is being built of partinium, a new aluminum alloy, which is stated to combine great strength with lightness. The body will, it is stated, only weigh about a third of one constructed in the ordinary way of wood and metal.

25 H. P. RACING CARRIAGE.

For a long time there has been a tendency among French racing chauffeurs to go in for carriages fitted with motors of increased power, until now engines of 12 to 16 h.p. have become the rule on racing vehicles in France. It is now stated, however, that M. Lemaitre is having a new carriage built by the Peugeot Co., which will have a 25 h.p. engine.

The announcement made by De Dion & Bouton, of Puteaux, France, that they had decided to make their well-known De Dion motors of a slightly larger size—to indicate 2¼ h.p. in place of 1¾ h.p.—has led to a similar course being taken in this country. The Motor Mfg. Co., Ltd., and the Beeston Motor Co., Ltd., both of Coventry, are now making arrangements to turn out 2¼ h.p. motors.

GASOLINE NOT STEAM BUSES THIS TIME.

A shareholders' meeting of the London Steam Omnibus Co., Ltd., was held the other day, when the chairman stated that "we have worked out the omnibus itself, which when we started was only a success on paper, into a proved mechanical success. It has been tested practically by running over 1,000 miles on every description of road without a hitch, and at a cost which, under good management, will yield enormous

profits as compared with those of the horse omnibus. We have concluded a valuable contract for the building of 80 omnibuses, and my advice is not to lose a moment in getting them at work in the streets. It would be a good stroke of business to offer the builders, who are the Daimler Motor Co., some inducement to get a considerable number out in advance of the agreed time, so as to be ready for the spring traffic next year." The point of the joke is that the omnibuses are not driven by steam but by gasoline motors! Why not change the title of the company?

HONG KONG TO PARIS AND LONDON.

A member of the Automobile Club of Great Britain proposes to make this journey on a motor vehicle, starting from Hong Kong at the end of February, 1900. He desires a traveling companion, a good photographer preferred. The Secretary of the Automobile Club can give further particulars.

The Liverpool Self-Propelled Traffic Association has decided to hold a further series of trials of heavy motor wagons about the beginning of October, 1900. At a recent meeting of the association it was resolved to request the local members of Parliament to take steps to secure the introduction of a short bill to enact the increase of the fare limit from 3 tons to 4, as the effect, at present, is to increase prime cost very greatly—owing to the use of aluminum and other expensive metals—or to tempt manufacturers to cut down bearing surfaces and factors of safety in construction. This matter was strongly commented upon in the report of the judges for last year's trials, and is still a great drawback to progress in heavy vehicles in England.

The recent talk of a race between Winton and Charron seems to have given an idea to English chauffeurs. Hitherto few if any automobilists have done more than act as interested spectators in the many motor vehicle races which have taken place on the Continent. I learn, however, that for the coming race between Paris and Ostend two English chauffeurs have already sent in their entry.

At a meeting to-day of the shareholders of the London General Omnibus Co., Ltd., the chairman stated that he was "on the lookout to see what could be done with motor vehicles." He believed electricity would come in some day for the company's vehicles. This company during the first half of the present year ran 1,275 omnibuses 14,750,000 miles, and carried during that period no less than 97,000,000 passengers.

There is said to be only one house of any pretensions in Paris that can make immediate deliveries of motor carriages. Most of them require from four to eight months, while Panhard & Levassor take twenty months and De Dietrich & Co. ten months.

A new company with \$100,000 capital has been organized at Levallois-Perret, near Paris, to build electric vehicles and establish electric charging stations. Hart O. Berg, manager of the Clement works, is prominently mentioned.

At a recent session the Automobile Club of France took up the subject of motor vehicle accidents, and decided, owing to their growing frequency, to dispatch an engineer to the spot immediately on receiving news of a motor accident in order to determine the cause and prepare an official report on it.

The Automobile Club de France announces that the regulations governing the Gordon Bennett Cup will be submitted to the principal automobile clubs of the world for consideration and that, as suggested by Sir David Salomons in his letter recently published in our columns, all kinds of motors will be allowed to compete.



THE RUMPF GASOLINE CARRIAGE.

St. Louis Gasoline Stanhope.

At No. 121 N. Vandewater Ave., St. Louis, Mo., is one of the few buildings in the United States erected specially for the manufacture of gasoline vehicles. It was built and is occupied by the St. Louis Motor Carriage Co., the oldest concern in this line of business in the western section of the country.

The building, which is 115x40 ft., is well equipped with the necessary machinery to turn out motor vehicles complete, including wood work. Several vehicles like that illustrated here were in process when the editor of *The Horseless Age* recently called at the factory, and the model after which they were being constructed scarcely showed the effects of the thorough road work which it had done during the past six months.

The carriage which they are now putting out is a graceful stanhope, weighing 1,000 lbs., and propelled by a two-cylinder, horizontal motor of 6 h.p. The cylinders are made of cast iron, and are of 4½-in. bore and 6-in. stroke. The usual water jackets are found necessary, the circulation being by gravity. The cranks are balanced at 180°. Ignition is electric, by means of a contact spark, and the carbureter is under the regulation of the motor.

The frame is of angle steel, which is preferred by reason of its greater strength and the ease with which other parts may be attached to it. The wheels are of wood or wire as the customer may select, the wooden wheels having metal hubs and steel rims. Three-inch pneumatics complete the wheels.

The rear axle is solid and has roller bearings. The transmission gears are all tightly encased in a box fastened upon it, running noiselessly in oil. Steel meshes with bronze.

The gear speeds are two forward and one reverse, the variable speed motor furnishing the intermediate speeds. The maximum speed is 15 miles an hour.

One friction clutch only is employed. When the vehicle is standing the gears are disconnected, a catch preventing the

engagement of the clutch unless the gears are in perfect mesh, and thus preventing stripping of the gears in the hands of a novice. Power is transmitted to the axle through a chain.

The differential and the regular pivoted steering are seen, the steering axle having ball bearings. One end of the differential works on a hollow shaft and the other on the axle.

The control of the carriage is accomplished by two levers at the right hand side of the vehicle. One throws in the clutch, and when the clutch is thrown out applies the brake; the other shifts the gears.

The speed of the motor is regulated by a pedal.

The muffling device is very simple. It consists of a cylinder about 2 ft. long and 6 in. in diameter, placed underneath the body and containing a number of steel plates full of small holes. A row of larger holes in the center of the outer circumference allow for the final escape of the exhaust.

A new and distinctive feature of this carriage is the method of automatic lubrication of the bearings, similar to that employed in high speed electric machinery, and positive in any kind of weather. With this system the bearings require oiling only once a week.

The water tank, holding 10 gals., is concealed in the rear.

The finish and upholstery are in excellent style, and the continuous mud guards are both useful and ornamental, adding the finishing touches to the design.

American Gasoline Dos-a-Dos.

The dos-a-dos herewith shown is the first of a lot of 50 carriages which the Automobile Co. of America are now putting through.

Its total weight is 1,200 lbs. The frame is made of angle iron and the axles of hollow tubes, the rear one being 2½ in. in diameter.

All four wheels are 32 in. in diameter to secure uniformity in tires, rims and spokes. The hubs are 6 in. in width, and the spokes are attached to them without bending so that the pull is always direct. Roller bearings are used in the rear hubs and ball bearings in the front hubs. Flat tread pneumatics are employed.

The usual differential gear is encased on the rear axle in the same place as the sprocket.

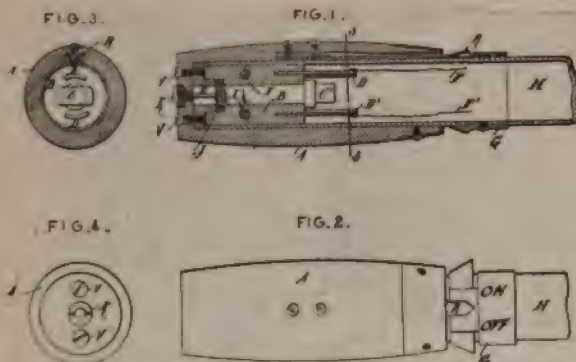
A 7-h. p., two-cylinder gasoline motor weighing 350 lbs. and self lubricating, transmits power to a countershaft, on which are the speed-changing gears, giving three forward and one reverse speed. These gears are noiseless, rawhide meshing with brass.

The reverse is operated by a pedal, while a second pedal controls the brake. On the left hand side of the seat is the speed lever, which works up and down, at the same time operating a bell.

Several different styles of body are furnished to suit the purchaser's taste, including a break, physician's phaeton, etc.



GASOLINE STANHOPE. ST. LOUIS MOTOR CARRIAGE CO.



A differential friction disk of compressed paper transmits the power by one sprocket chain to the rear axle. The inventor states that he found the friction disk consumed less power than the gears.

Temporarily Excluded from Fairmount Park.

At a meeting of the Fairmount Park Commission, Philadelphia, Pa., on Monday, Aug. 21, it was decided that automobiles should be excluded from the park confines until the Commission should establish rules and regulations for the safety of the public.

The committee appointed to investigate the motor vehicle and gather data in regard to its status and behavior in other cities and other countries made its report, which was not altogether unfavorable, and a resolution as above was passed.

The rules will probably be framed in time to be presented at the next regular meeting of the Commission in September.

The Holley Gasoline Carriage.

We are now able to publish a photograph of the Holley gasoline carriage, a brief description of which appeared in a recent issue of this journal. It is a light three-wheeler, with single drive wheel in the rear, and motor placed farther forward than in the Bollee type of machine.



FRONT VIEW OF HOLLEY CARRIAGE.



GASOLINE THREE WHEELER, GEO. H. HOLLEY, BRADFORD, PA.

COMMUNICATIONS.

Hand-made Steering Axles.

July 24, 1899.

Editor Horseless Age:

I can imagine the smile upon the face of the machine shop owner when I say that this letter is written with the object of keeping the unwearied motor carriage experimenter out of trouble.

The average enthusiastic experimenter expects to be fleeced—one of the few expectations, by the way, in which he is not disappointed.

In a recent issue of your journal Mr. Sperry described in some detail the correct theory for the steering of the motor carriage. It seems to me, nevertheless, useful to go into the details of construction of one method, at least, of carrying out such a theory.

I have recently had a pair of steering axles made throughout by hand on what seems to be a cheap, efficient and strong plan.

A bar of nickel steel 3 ft. long and 1 in. square was obtained. This was taken to a blacksmith and bent, after having been cut in two, into two hooks, as will be seen from the drawing. The main point in working this material is to avoid a greater heat than a bright red.

Referring to the diagram, A B C represents the material.

The portion A is turned to a slightly tapering cylinder, fifteen-sixteenths of an inch in diameter at the point E prime. At the end D of the cylinder a screw is cut to be used eventually for lock nuts. The cones E and E prime slip over the

cylinder A, E prime coming against a shoulder where the cylinder ceases, and E retaining its position is supported on one side by the lock nuts, and upon the other by the balls and ball cup of the hub, not shown.

The depressions L and P of 30 and 60 degrees, respectively, were then cut, the material being mounted in the lathe and the holes F F prime were bored and threaded as in the drawing.

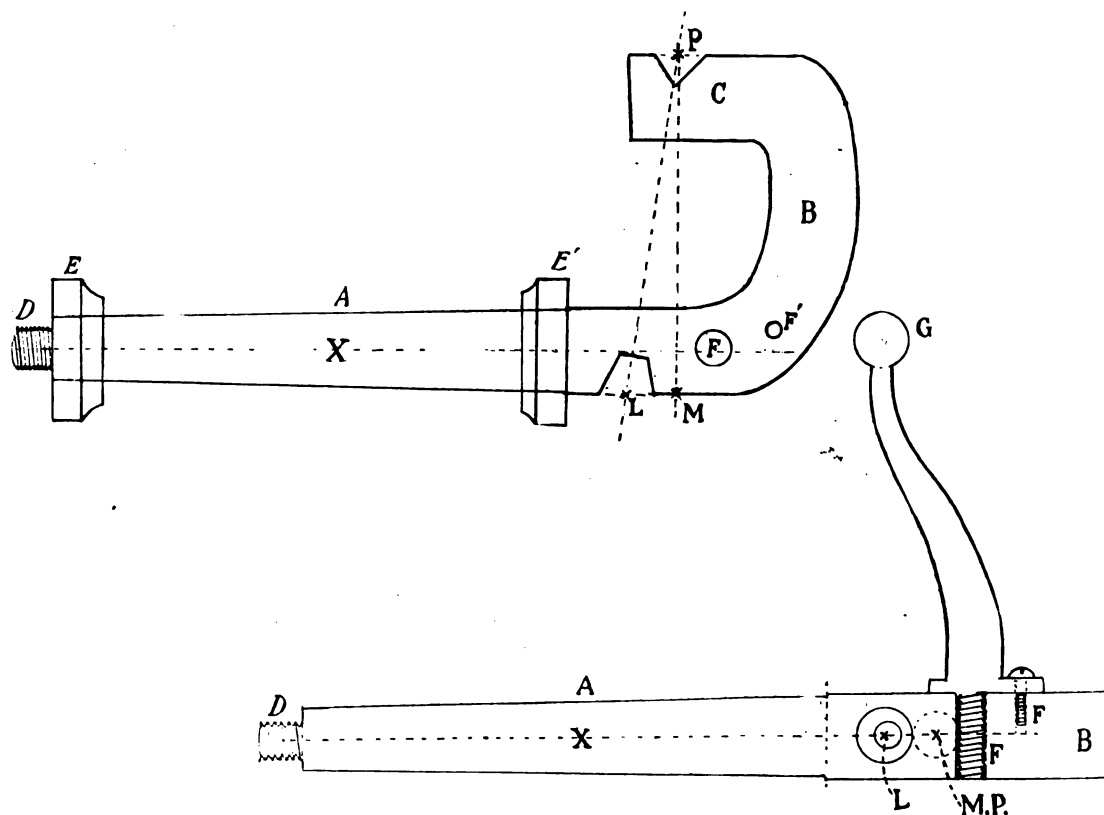
Little requires to be said about the forging G, as the drawing explains itself. For convenience of calculation, however, it is well to have the universal joint in a line which leaves D B at right angles from the point L.

In laying off the various distances of the above points, one must take into consideration the length of the hub and the diameter of the wheel. It is essential that the line P L should pass through a point upon the circumference of the wheel somewhat in advance of its point of contact with the ground. Its anterior displacement will be determined, of course, by the position of the pins which fit in at P and L. The distance L M, however, we must now calculate in the following way. The radius of the wheel: the distance A M = P M : L. M.

For example, if the radius of the wheel is 15 in. and the distance from the middle of the hub to M is 4 in., while the distance M P is 4 in., we have $4 \times 4 = 16 \div 15 = 15/16$, which in this case will be the distance L M.

A word in respect to nickel steel may be of interest to your readers.

This steel contains 5 per cent. of nickel and a small amount of carbon. This combination, if oil-tempered, becomes moderately hard; at the same time, however, it acquires the property to a marked degree of resisting the granulating effects of vibration.



HAND-MADE STEERING AXLE.

In my particular instance, this method of tempering was not used, however, as I feared that I might thereby warp the axle A and thus injure its bearing qualities.

I would like to add that these axles are now in successful use.

Yours truly,
VIATOR.

On Freight Classification.

Peoria, Ill., Aug. 28.

Editor Horseless Age:

Your views regarding freight classification are certainly endorsed. Previous to July 1 horseless vehicles were rated as "motocycles," and if set up were charged first-class rate with a minimum weight of 4,000 to 5,000 lbs. This rating was manifestly unfair, whether through ignorance or intention is not for us to say.

On July 1, '99, the official classification covering all shipments eastward was amended to make the same rates apply to motor vehicles as to horse vehicles, a very sensible ruling. We can now ship, K. D. & Ctd., at 1 to 1½ times first-class rate by weight, and have no complaint to make on Eastern shipments.

On Western shipments, however, the old rating still prevails, and our buyers must pay three and one-half times first-class if K. D. & Ctd., or first-class with 5,000 minimum if shipped set up. We have asked for fairer rating, and cannot doubt that the Classification Committee will see the justice of it and grant the same. It is certainly a rank injustice as it now stands. Our California customers are complaining bitterly, and a recent one from San Diego is seriously proposing to drive through overland.

Motor vehicles are heavier for a given bulk than horse vehicles, but at the same rate would be a more profitable freight. The objection may be raised that electric vehicles should be higher because of danger from leakage or breakage, but this could be met by removing the batteries and shipping as batteries in separate package. Or, as will eventually be done, a rating for each class of vehicle can be provided. As the business grows these hardships will be set right, but in the infancy of the business is when the obstacles are most needed out of the way, and we trust the rates will be made more equitable very soon.

DURYEA MFG. CO.,
C. E. Duryea, Mgr.

Little Use for Grade Meter.

Washington, D. C., Aug. 26.

Editor Horseless Age:

Misinformation seems to be epidemic in all matters related to motor vehicles. In the Aug. 23 number is a cut of a grade meter which at first glance appears very easy, although it allows the vehicle to make a hundred per cent. grade before it registers 25. Mr. Loomis evidently takes the level for zero per cent. and vertical for 100, and then he divides up the 180 degrees which he takes for 100 per cent. grade.

Grade percentage is the ratio of elevation to base line, and cannot be calculated from a protractor. The angle, however, of a 100 per cent. grade is 45 degrees, but it does not follow that that of a 50 per cent. grade is one-half of 45 degrees—for it is not. The sketch shows grades of 10, 15 and 100 per cent., and the pendulum if it admitted of use would indicate grades up to 100 per cent.

THE HORSELESS AGE

Vol. 4, No. 22, Aug. 21.

If the pendulum was 10 in. long 1 in. displacement would indicate 10 per cent. grade and 1-10 in. displacement 1 per cent. As a city grade of 8 per cent. is a rarity, and as the tires or springs allow the vehicle body to vary position much more than would result from grades encountered, the grade meter can have little utility.

Yours truly,
J. B. CHAMBERLAIN.

Has Invented a Muffler.

San Diego, Cal., Aug. 21.

Editor Horseless Age:

As I have received a number of inquiries in regard to where the mufflers referred to in my former letter to you were made, would say that I am the inventor and manufacturer of the one referred to. As it is very small and light and causes no back pressure, it is particularly adapted to motor vehicles and launches. It is the same muffler used on the motor bicycle described in The Horseless Age of May 24.

Yours respectfully,
W. E. STEFFEY.

Believes in Springs, Not Pneumatic Cushions.

Boston, Mass., Aug. 25.

Editor Horseless Age:

In your issue of Aug. 23 there is a description of a pneumatic cushion for moving vehicles, that, to the novice, would be very alluring and exceedingly dangerous, for he would immediately decide that it was a good thing, whereas the principle is a delusion and a snare.

First. Air is not a cushion, it is a solid body.

Second. Air can never be used as a spring, because it is not an absorber.

Again, that unfortunate word, resilient. How it is misunderstood and misapplied! Webster gives the definition, "Inclined to leap or spring back, rebounding."

Is that what is wanted in a device to ease the shocks of the wheels rising and falling? I think not. Air and rubber are absolutely incapable of making any moving vehicle running upon an uneven plane ride free from vibrations. They never have and they never will. It requires a proper combination of steel springs to do this.

GRAHAM EQUIPMENT CO.
J. Hector Graham, Mgr.

Wants Court Decisions in Motor Vehicle Damage Suits.

Rochester, N. Y., Aug. 19.

Editor Horseless Age:

Kindly give me the decisions of the court in any motor carriage damage cases that may have come to your notice. I refer especially to such cases as mine, where suit has been brought to recover on account of horses being frightened by motor carriages in the highway or city street.

Anything that you may be able to give me in this line will be appreciated.

Yours truly,
J. B. WEST.

QUESTIONS AND ANSWERS.

The Differential Gear.

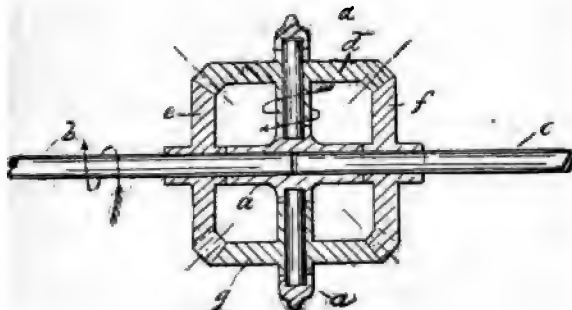
Amesbury, Mass., Aug. 17.

Editor Horseless Age:

Will you kindly explain the functions of the nest of four bevel gears used on the rear axle of motor carriages? We suppose this may have been done in some issue of your valuable magazine, but we have not seen it, and there are others who have not.

Yours respectfully,
CARRIAGE MACHINE CO.

Let us suppose that the two driving wheels are rigidly attached to the ends of a single piece of shafting, the latter forming the rear axle. On the shaft is mounted a sprocket driven direct by a chain from the engine. Assuming that the wheels are 5 ft. apart on the axle, and that an attempt is made to turn the carriage inside a circle 20 ft. across, the outer wheel will travel along a path 62.832 ft. long and the inner wheel at the same time will move over a distance of 47.124 ft. As the tendency of the wheels is to turn at different speeds corresponding to these distances, it is evident that the wheels



must slip, or axle twist, in moving around the circle. Suppose we proceed to free the sprocket so that it will turn easily on the axle, and, having the latter in bearings to preserve the alignment, imagine the axle cut in two at the middle. Insert in place of one of the sprocket arms a stud and mount on this a bevel gear meshing with two other bevel gears on the shafts; the shaft gears are keyed and the gear in sprocket runs loose. For convenience we will give the three gears the same number of teeth and then we will lift the carriage off the ground, start up the engine and allow the wheels to turn. If the carriage wheels are turning at the same rate it is evident that the sprocket might just as well have been keyed to the axle, for while the sprocket gear is revolving around the shaft it does not rotate on its own axis. But let us apply a board to the rim of one of the carriage wheels, as a brake. As the wheel slows up and stops the wheel on the opposite side rotates more rapidly. In the sketch let a be the sprocket with miter gear d; b and c the divided shafts, and e and f miter gears fastened to b and c, and in mesh with gear d. If the shaft c be held immovably and the top of the sprocket a be moved away from the spectator and around c, then d will revolve also about c, as well as rotate upon its own axis in a, and thus b and e will rotate twice for each turn of a. And if b were held and c allowed to turn the action will be the same, and further if either is delayed, or runs at any less speed than the sprocket a, the other shaft will turn the faster. Hence with such an arrangement the wheels turn in accordance with the paths upon which they roll. The gear g has

exactly the same purpose as d, and the one tends to balance the strain on the other. The subject, differential gearing, is a very interesting and complicated one; some of the leading mechanical authorities are at variance so far as theory goes (as see Prof. McCord's examination of Rankine). The writer has endeavored to render the compensating arrangement plain, since a clear acquaintance with its principle may prove of service when considering the various forms of reducing gears that will continue to come forward for investigation.

R. I. C.

Valve and Piston Head Areas.

Mooresville, Ind., Aug. 10.

Editor Horseless Age:

Will you please answer in your columns of communications in The Horseless Age the following: In a gasoline engine what proportion ought the area of the inlet and exhaust valves bear to the area of the piston head?

Yours respectfully,
A. B. CALVERT.

If we consider two cylinders of the same diameter, in which the one has a stroke of different length from the other, it is evident that the one with greater stroke will require ampler valve surface than the other. Similarly with two engines of like dimensions as to diameter and stroke, but running at different speeds.

Theoretically, therefore, we may say that the area of the valves, inlet and exhaust, should bear a definite ratio to the volume and the speed. The amount of compression space and its effect upon this proportion is a factor not easily determined, and the practice among the several manufacturers does not seem based upon any generally accepted rule. This divergence is due, doubtless, to the points cropping up in design having varied the values. Thus the larger the valve the less friction, the more even charge, the quicker and more complete the evacuation of the products of combustion, etc. Against this series must be placed the less expense in machinery of a small valve and seat, the less distortion by heat, and the greater ease of operation and repair, which mean longer periods of cam surface efficiency as well as continued activity of the engine. At best the matter is a compromise, sometimes carried to the extreme, where the designer takes both horns of the dilemma and fits a small supplementary valve to relieve the pressure upon a large one.

The writer has in hand some material for The Horseless Age illustrative of explosive engine practice, here and abroad, and will welcome any data based upon actual experiment.

R. I. C.

Why Are Gas Engines Single Acting?

San Francisco, Cal., Aug. 10.

Editor Horseless Age:

I should like to submit to your engineer for answer through the columns of The Horseless Age this question: Why are nearly all gas engines made single acting, and what would be the disadvantage of their receiving an impulse through both ends of the cylinder the same as a steam engine?

Truly yours,
C. E. HOWARD.

The main difficulty with an explosive engine is the high temperature after ignition and the consequent disadvantages. It is no easy matter to keep the cylinder cool enough to prevent deterioration of the metal surfaces and, on the other hand, obtain the high temperatures incidental to complete and economical combustion of the charge. The cylinder of a steam engine cannot be too warm from a theoretical standpoint—to offset cylinder condensation, etc.—hence the design of the two classes of motors involves entirely different treatment.

A gas engine in which the piston received an impulse on each side would subject the piston rod and packing to severe conditions, and there is no obvious way of protecting the rod, although the piston can be suitably relieved. See answer to R. T. N., July 12, 1899.

R. I. C.

The "Main" Zinc Cell.

Colorado Springs, Colo., Aug. 23.

Editor Horseless Age:

Referring to the article upon storage batteries in your issue of July 5, will you kindly inform me if sheet zinc may be employed in place of copper, zinc plated, as one of the elements of the "main" cell there described? If not, will you describe the best method of plating the copper—that is, the correct bath to use to obtain best results?

Yours respectfully,

W. O. ANTHONY.

Sheet zinc will not do unless renewed very frequently, owing to the uneven action of the current, both in charging and discharging.

For the electrolyte mix up a solution of sulphuric acid and water to 1.2 sp. grav. corresponding to about 20 per cent. acid to 80 per cent. water, and dissolve about 1 lb. of metallic zinc in it (for 100 ampere-hour cell) oxide of zinc can be used. Amalgamate the copper with metallic mercury or, what is easier, mix an ounce of bisulphate of mercury in the solution; this will amalgamate the copper as soon as they are dipped in. It is also necessary to put mercury in the cell as described. The copper will begin to plate as soon as the charging begins, which should not be delayed. H. E. D.

Boston, Mass, Aug. 25.

Editor Horseless Age:

Can you give me some information in regard to gasoline? How can its specific gravity be tested? Can you refer me to the best authority on the subject?

W. A. FAVER.

1. The specific gravity of gasoline is measured by an instrument called a hydrometer, made by some thermometer manufacturers.

2. We would recommend Professor Boverton Redwood's work on petroleum and its products.—Ed.

Wants an Ignition Dynamo.

Toronto, Ont., Aug. 23.

Editor Horseless Age:

Kindly inform me where I can obtain a dynamo sufficiently powerful to ignite two gas engines of 4 h.p. each. The engines are coupled together, and have but one 18-in. fly wheel, to which the dynamo will be connected by belt. The engines have variation of speed from 200 to 900 revolutions per minute.

Kindly reply at your earliest convenience, and oblige.

Yours truly,

E. GUY.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

MINOR MENTION.

Shuger Bros., Coldwater, Mich., are building a motor carriage to weigh 500 lbs.

The Baltimore Automobile & Mfg. Co. have moved their office to their factory, 872 Park Ave.

The Terre Haute Carriage & Buggy Co., Terre Haute, Ind., is said to be contemplating the manufacture of motor vehicles.

Frank D. Maltby, 10 Clinton St., Brooklyn, N. Y., will establish a motor emporium in connection with his bicycle business.

The MacLearn Automobile Co. has been incorporated in New Jersey with \$100,000 capital by John P. MacLearn, Wm. A. Black and W. W. Hise.

The Oakman Motor Vehicle Co. expect to retain and enlarge their present plant at Greenfield, Mass., devoting it to the supply of the New England trade.

There is such opposition to a trolley at Morristown, N. J., that motor omnibuses are likely to be introduced before the trolley company can get a franchise.

Gaston Vinet, 25 Rue Brunel, Paris, dealer in automobiles and accessories, wishes to take the continental agency for some American manufacturer of motor vehicles.

Hugh Kelley, of 71 Wall St., New York, who has large interests in Cuba, has lately had a steam traction engine built, which carries 30 tons of sugar cane on trailing wagons.

George Wattereau, owner of the omnibus line between Grass Valley and Nevada City, Cal., has placed an order for four motor vehicles, each to seat sixteen persons. The fare will be reduced from 25 cents to 15 cents.

The organization of the Woods Motor Vehicle Co. to take over the business of the Fischer Equipment Co., Chicago, Ill., has been perfected. A large factory will be built on Wabash Avenue, Chicago, and a New York office will be opened.

The Detroit Automobile Co., recently organized at Detroit, Mich., has secured the plant of the Detroit Motor Co., at Cass Ave. and the railroad. Machinery is being installed, and it is expected that carriages will be put on the market before the first of the year.

A new Maine corporation is the Atlantic Automobile Mfg. Co., capital \$500,000. The incorporators are H. A. Rens, Kingston, Mass.; W. F. Marsh, L. J. Wilber, E. H. Reynolds and A. R. Marsh, of Brockton, Mass., and O. C. Bird, East Bridgewater, Mass.

A syndicate has purchased the bicycle plants of the Massey-Harris Co., Toronto; H. A. Lozier & Co., Toronto Junction; the Gould Bicycle Co., Montford, and the Welland-Vale Co., St. Catharines, all in Ontario, Canada; has capitalized the combined enterprise at \$6,000,000, and will at once take up the manufacture of motor vehicles.

OUR FOREIGN EXCHANGES.

An Australian Steam Carriage.

The Autocar illustrates a steam carriage built by Herbert Thomson, of Melbourne, Australia. The carriage is thus described:

"It is a four-wheel phaeton built of fiddle back ash and silky oak; the workmanship is high class. It seats six persons, including the driver. The wheels are 38 in. and 48 in. in diameter, fitted with 2½-in. Dunlop pneumatic tires. It is easily steered by a hand lever controlling the front wheels. The engine is a vertical compound, tandem cylinders, 1½ in. and



AUSTRALIAN STEAM CARRIAGE.

3 in. diameter, and 3 in. stroke; it is fitted with a single slide valve, which actuates both cylinders; it has one steam chest. The engine runs up to 1,000 revolutions per minute. The generator is placed under the seat, its size being 14 in. x 18 in. x 18 in., and it is tested to 600 lbs. The feed water is heated to the boiling point with exhaust steam, before entering the generator, and the feed pump is so fitted as to be always pumping water. The fuel is ordinary kerosene oil, flash 150°, the generator being automatic. The exhaust steam is passed through a condenser under the carriage, the steam being condensed and the water used again in the generator, thus doing away with having to carry a large quantity of water. The speed of the car is controlled by a throttle valve placed near the hand. The weight of the machine is 1,050 lbs."

Automobile Club's Storage Battery Tests.

The result of the storage battery tests organized by the Automobile Club of France has recently been published for the months of June and July. The following table gives the percentage of efficiency; the initial following each name designates the nationality of the contestant:

No.	NAMES.	June.	July.
1	Société Travail Electrique des Métaux (F.).....	73.4	72.5
2	Société Générale Electrique de Nancy (F.).....	60.6	65.1
3	Société Française Tudor (F.).....	65.6	65.8
4	Société Belge Tudor (B.).....	56.6	30.2
7	Société Cruto (It.).....	56.3	71.2
8	Lagarde (F.).....	69.5	38.1
9	Wuste et Rupprech (Aust.).....	36.6	22.2
10	Compagnie Blot (F.).....	73.6	74.1
11	Fulmen (F.).....	75.6	68.3
11	Phénix (F.).....	61.9	69.9
13	Phénix (F.).....	58.2	26.5
16	Hathaway (E.).....		
17	Soc. Soudures Electrolytiques (F.).....	57.5	42.8
18	F. Heime (Aust.).....	44.2	42.6
19	Pope et son (E.).....	70.1	
21	Phénix (F.).....		
22	Pope et son (E.).....	62.5	59.7
23	F. Heime (Aust.).....	35.5	9.8

Some of these batteries are already thrown out of competition because they short circuited four times. Nos. 23, 19, 8 and 18 are in this category. No. 4 short circuited twice, 17 and 13 three times and 11 once.

The artificial shaker, which was devised to secure as far as possible the conditions of road traction while the batteries were under test, did not work as well as anticipated.

The Automobile Annual.

A comparison of the new edition of Thevin & Houry's "Annuaire general de l'Automobile" with last year's edition will give some idea of the astonishing growth of the motor vehicle industry in France and other European countries during the past twelvemonth. The present volume contains 1,200 pages, while the previous year's had but 675. A summary of this great directory gives the following results by countries:

TABLE OF THE EUROPEAN MOTOR VEHICLE TRADE.

	Manufacturers.	Dealers.	Mechanics and Repairers.	Petroleum Depots.	Electric Shops and Charging Stations.	Owners of Automobiles.
Paris.....	292	79	35	730	50	1065
Provinces.....	327	928	1060	3209	215	4541
France.....	619	998	1095	3939	265	5606
Germany.....	76	68	57	110	....	268
Austro-Hungary.....	18	18	12	26	....	90
Belgium.....	63	53	68	148	....	392
Spain.....	....	10	4	7	....	44
Great Britain.....	49	25	....	29	....	304
Italy.....	26	26	24	25	....	111
Netherlands.....	11	22	8	13	....	68
Switzerland.....	24	27	26	36	....	114
Other Countries.....	2	13	4	12	....	35

No More Electric "Fiaccres" in Paris.

The electric cabs of Paris have ceased to be public cabs—"fiaccres," as they were termed according to the police regulations—and have been put under another classification—"voitures de grande remise," whose motormen make their own terms with their clients. The change is variously explained, but is taken to indicate an unsatisfactory state of affairs at the financial end of the Paris electric cab promotion scheme. The daily expense of operating an electric cab in Paris is estimated at about \$4, but the item of the maintenance of batteries is undoubtedly underestimated. The cost of maintaining a horse cab, the same authority says, is a little cheaper.

The Compagnie des Petits Voitures, which has been operating the cabs, gives as a reason for the change that constant complaints were made to the Prefect of Police by patrons of the cabs because of the refusal of the motormen to charge by the hour or the mile, as they were required to do,

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 631438—Self-Propelling Vehicle.—Reuben H. Plass, of New York, N. Y., Assignor to Isabella C. Plass, of Same Place. Application Filed Jan. 9, 1890.

Fig. 1 is a perspective view of a delivery wagon having the invention applied thereto. Fig. 5 is a side view showing the engine and its clutch in operative position. Fig. 6 is a plan view; and Fig. 7 is a front view of the engine and its supports, the clutch being shown in section.

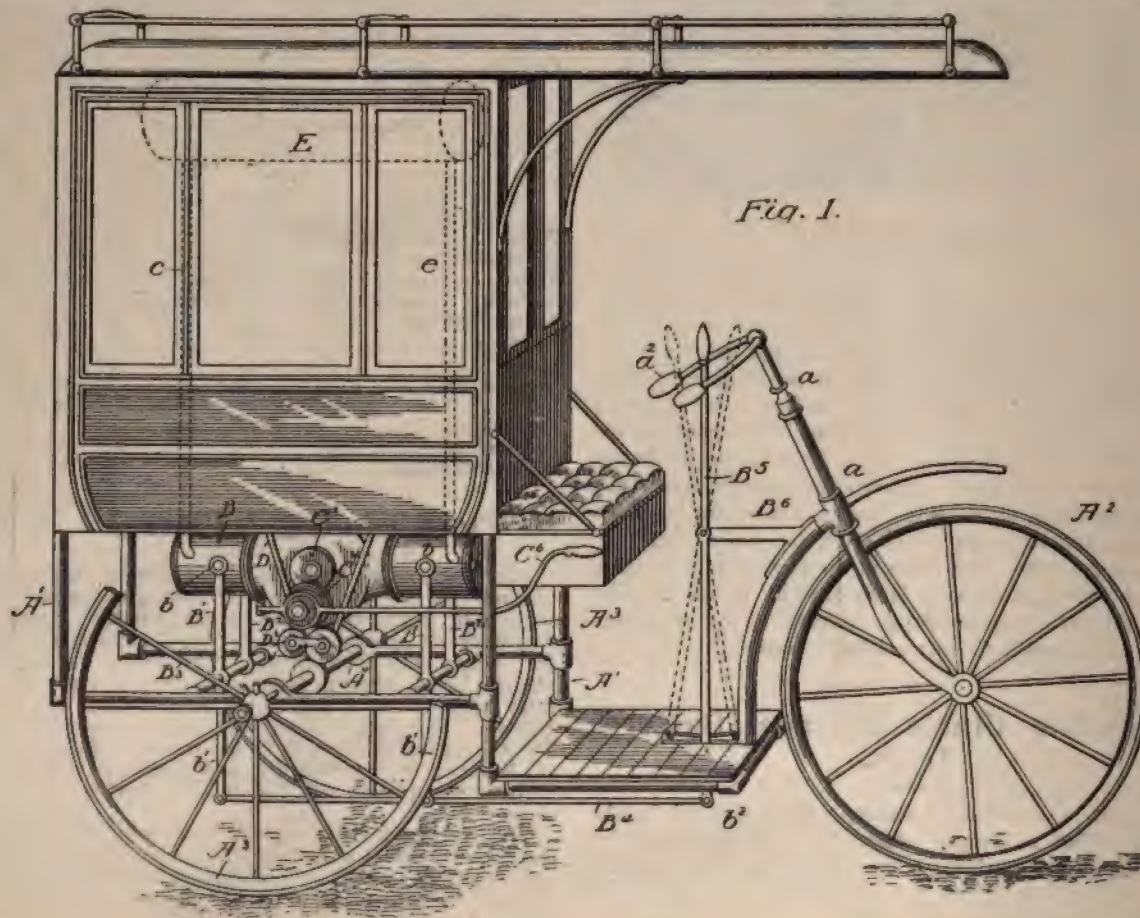
The engine is mounted on upright rods B' B' B^2 B^2 , which are respectively pivoted on horizontal rods B^3 attached to the frame of the vehicle. Each of the rods B' B' B^2 B^2 is pivotally connected at their upper ends at points b to the engine. The rods B' B' have downward extensions b' b' , to the lower ends of which are pivotally connected a rod B^4 . A lever B^5 is pivotally connected at a point b^5 to the rod B^4 , and the rod B^5 is pivoted in an extension B^6 from the frame of the vehicle. This construction permits of the shifting of the engine B by moving the lever B^5 .

The main shaft C of the engine is provided with a friction wheel C' , which is arranged in contact with a friction wheel C'' , arranged on the end of a shaft C^3 , which is mounted in bearings projecting from the frame of the engine. Loosely mounted on the shaft C^3 is a friction wheel C^4 , which is provided in its outer face with a tapering opening adapted to receive a block C^5 , which is connected to the shaft C^3 and adapted to slide thereon. The block C^5 is provided with a groove c , which receives the fork end of a lever C^6 , which extends to a position near the front of the vehicle and by which the block C^5 is capable of being slid on the shaft C^3 .

The wheel C^2 being always in contact with and actuated by the wheel C' on the shaft of the engine, it will be clear that by manipulating the lever C^6 the friction wheel C^4 may be caused to move with or be detached from the shaft C^3 . It will also be seen that by varying the contact between the parts of the clutch formed by the block C^5 and the opening in the wheel C^4 the relative speeds of the wheels C' and C^4 may be varied at will.

Mounted on a frame D , depending from the body of the vehicle, are the two friction wheels D' and D^2 . The friction wheel D' is arranged to be always in contact with the friction wheel A' on the axle of the vehicle and the wheel D^2 is arranged to be always in contact with the wheel D' .

By connecting the friction wheel C^4 with the driving shaft of the engine and by moving the engine through the lever B^5 to bring the friction wheel C^4 into contact either with the friction wheel D' or D^2 the vehicle will be driven in one direction or the other. When the parts move in the direction indicated by



BRITISH PATENTS.

No. 6606—Improvements in Motor Road Vehicles.—Pope Mfg. Co., Hartford, Conn. Application Filed March 27, 1899.

The running gear is composed of two parts, one of which is spring suspended and supports the body of the vehicle with the occupants, while the other part supports rigidly all of those parts of the mechanism which are necessarily aligned and is connected with the first part by a flexible or universal joint at one end, while the other end is carried by the driving wheels. The forward end of the second part has a flexible connection with the first part, so that it shall have three points of support (the single joint and the two wheels) so that it can always accommodate itself to a warped road surface. Such connection may be effected as represented in Figs. 2 and 3, in which the forward end of the substantially triangular frame C C' has a bracket arm C' which rests upon a small elliptic spring A' carried by the front axle B, this spring allowing the necessary freedom of movement in every direction. It may also be effected as shown in Fig. 4, and in Figs. 12 and 13 also, in which the front axle or one of the transverse bars of the body frame is provided with a depending bracket A', forming a socket in which is received the head of a bracket arm C', extended from the forward end of the other or gear frame. The rear end of this part of the frame is supported directly by the driving axle and wheels.

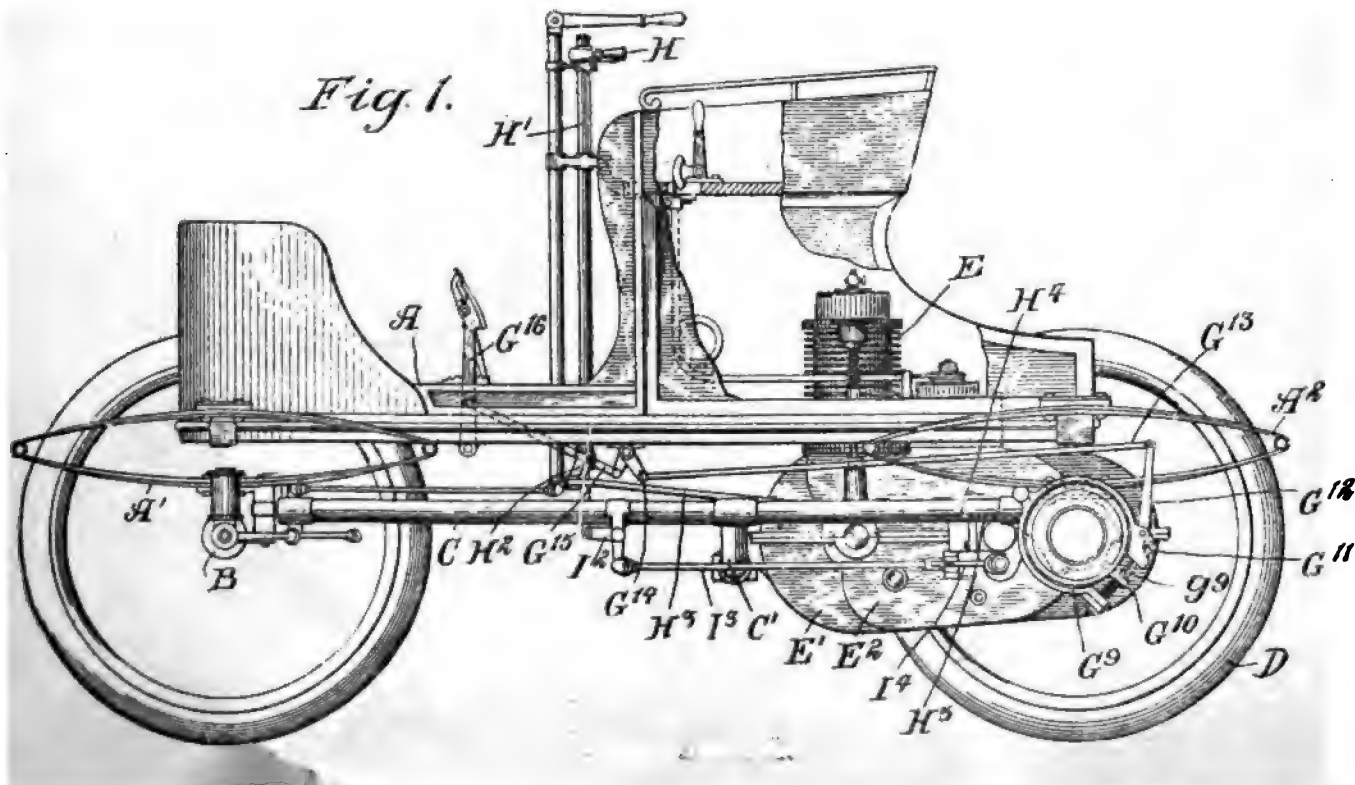
In the drawings a single motor E is shown, the casing E' of the motor and the gear inclosing casing E' being represented as secured together, virtually forming one rigid structure, supported at its forward end by the transverse bar C' and at its rear end by the driving axle and wheels. The shell or casing E' completely incloses all of the parts of the driving mechanism, including the change gear and the clutch, and has no openings except for the rear or driving axle, the connection to the change gear-controlling devices, the connection to the brake-actuating devices, and, it may be, the driving shaft. All parts of the driving mechanism are thus fully protected from dust and can be flooded with oil and kept clean.

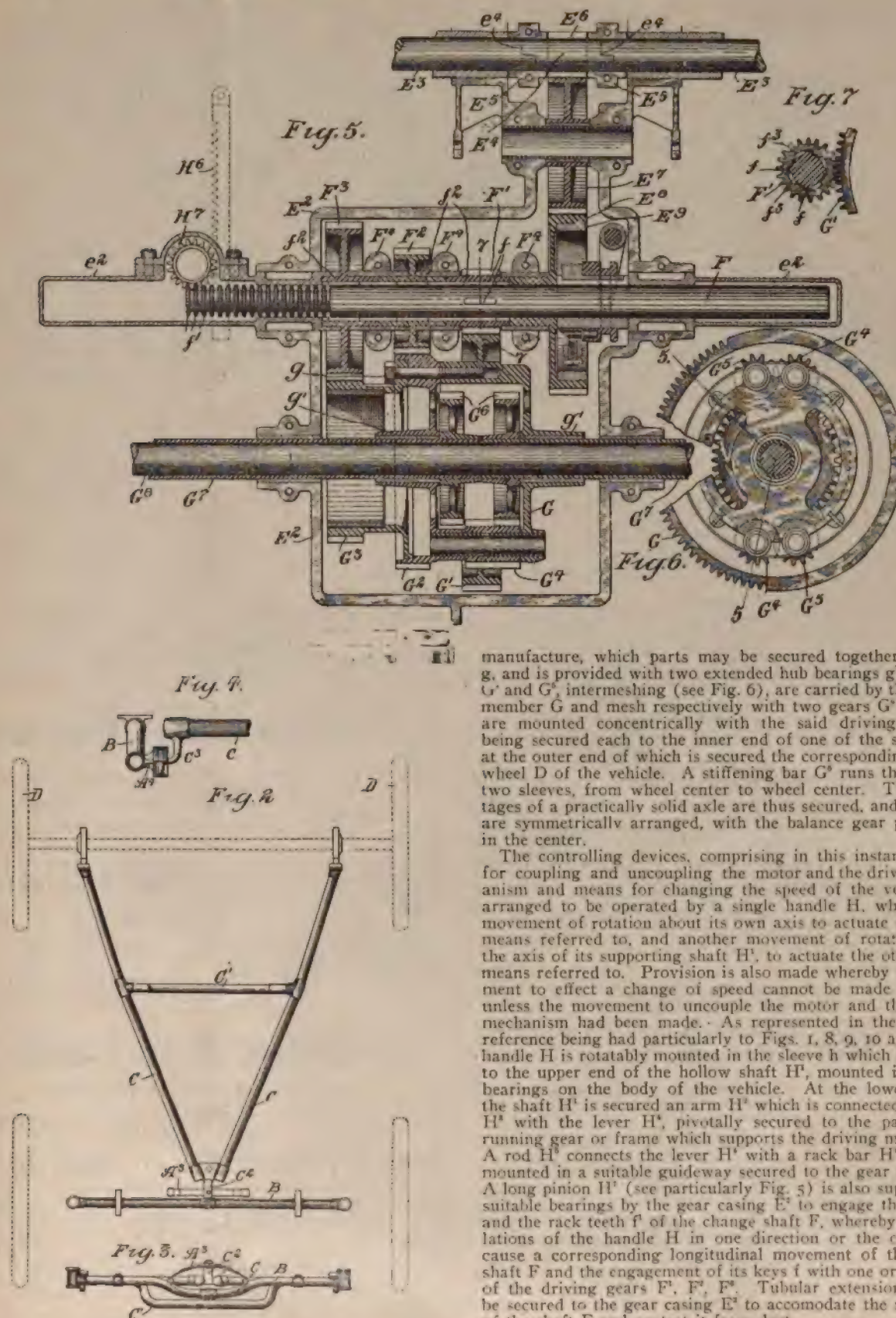
The driving mechanism, Fig. 5, comprises two motor shafts represented at E' E'. For convenience in coupling, the end of each shaft is cut or rabbeted transversely to half its diameter, and between the two shafts and in alignment therewith is an intermediate section E' which has its ends correspondingly

cut or rabbeted to half its diameter to fit the corresponding ends of the motor shaft E', as indicated at e'. Clamps E' are secured about the joints thus formed, bringing all parts to center without difficulty and securing them firmly together. The driving pinion E' is fast upon the intermediate shaft section E', meshing with an intermediate gear E', which meshes in turn with a gear E' mounted loosely on the change gear shaft F. The gear E' forms one member of a friction clutch of ordinary construction. The other member is indicated at E', being splined on the shaft to rotate therewith, although free to move longitudinally thereon, thereby providing for the coupling and uncoupling of the motor with or from the driving mechanism and driving wheels. The employment of a friction clutch permits the driven parts to be brought to speed gradually, and the location of the clutch between the motor and the change gear prevents the breaking of gear teeth when changes of speed are effected. The change gear shaft F is movable longitudinally to effect the engagement, by means of a spline or key f, with one or the other of the several driving gears which are supported concentrically with the shaft. For convenience in effecting the longitudinal movement, the shaft may be formed at its ends with circumferential rack teeth f' which are engaged by a pinion to be referred to hereinafter. The several driving gears F', F' and F' are supported concentrically with the shaft F, but are not supported by the shaft, and in consequence of this freedom of the gears from the shaft there is no burring, cutting and wear of the parts in use, which would otherwise make the movement of the parts hard and would eventually render them useless. Each gear is provided with an extended hub f', the several hubs being supported in outside bearing brackets F' which are secured to the casing E', each hub being formed internally with teeth or keyways, as indicated at f' in Fig. 7, for engagement with the spline f of the change shaft F.

The driven gears G', G' and G', which correspond and remain always in mesh with the gears F', F' and F' respectively, are secured to or formed upon the driving member G of the balance gear. All of the parts being rigidly supported by the casing E' and the running gear, and the parallelism of the axis of rotation being always maintained, the maintenance of the proper gear distance and the smooth running of the gears are always assured.

The driving member G of the balance gear is a frame or shell which may be made in separate parts, for convenience in





manufacture, which parts may be secured together by bolts g , and is provided with two extended hub bearings g^1 . Pinions G^1 and G^2 , intermeshing (see Fig. 6), are carried by the driving member G and mesh respectively with two gears G^3 and G^4 which are mounted concentrically with the said driving member, being secured each to the inner end of one of the sleeves G^5 , at the outer end of which is secured the corresponding driving wheel D of the vehicle. A stiffening bar G^6 runs through the two sleeves, from wheel center to wheel center. The advantages of a practically solid axle are thus secured, and the parts are symmetrically arranged, with the balance gear practically in the center.

The controlling devices, comprising in this instance means for coupling and uncoupling the motor and the driving mechanism and means for changing the speed of the vehicle, are arranged to be operated by a single handle H , which has a movement of rotation about its own axis to actuate one set of means referred to, and another movement of rotation about the axis of its supporting shaft H^1 , to actuate the other set of means referred to. Provision is also made whereby the movement to effect a change of speed cannot be made until and unless the movement to uncouple the motor and the driving mechanism had been made. As represented in the drawing, reference being had particularly to Figs. 1, 8, 9, 10 and 11, the handle H is rotatably mounted in the sleeve h which is secured to the upper end of the hollow shaft H^1 , mounted in suitable bearings on the body of the vehicle. At the lower end of the shaft H^1 is secured an arm H^2 which is connected by a rod H^3 with the lever H^4 , pivotally secured to the part of the running gear or frame which supports the driving mechanism. A rod H^5 connects the lever H^4 with a rack bar H^6 which is mounted in a suitable guideway secured to the gear casing E^1 . A long pinion H^7 (see particularly Fig. 5) is also supported in suitable bearings by the gear casing E^2 to engage the rack H^6 and the rack teeth f of the change shaft F , whereby the oscillations of the handle H in one direction or the other will cause a corresponding longitudinal movement of the change shaft F and the engagement of its keys f with one or the other of the driving gears F^1 , F^2 , F^3 . Tubular extensions e^2 may be secured to the gear casing E^2 to accommodate the movement of the shaft F and protect it from dust.

Fig. 8.

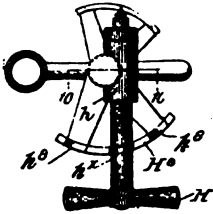


Fig. 10.



Fig. 9.

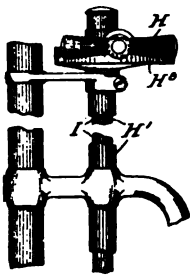
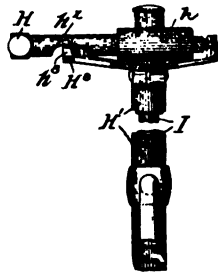


Fig. 11.



Provision is made for preventing accidental movement of the handle H, a notched arc H^a being secured in a fixed position near the upper end of the shaft H^1 and the handle H being notched or flattened as at h^x . When the handle is turned upon its own axis so that its notch h^x will clear the upper edge of the arc, the handle can be moved to one side or the other, but when the handle is turned upon its own axis to any other position it must engage one or the other of the notches h^a in the arc H^a and so be locked from movement to one side or the other. This rotary movement of the handle upon its own axis is taken advantage of to effect the coupling and uncoupling of the motor and driving mechanism, the movement to release the handle uncoupling the motor and the driving mechanism, so that the driving mechanism is always connected from the motor whenever a change of the speed gears is effected. As represented in the drawings (see particularly Fig. 10) the shaft H^1 above referred to is a hollow shaft or sleeve and receives within it a longitudinally movable bar I formed near its upper end with rack teeth i for engagement by a pinion I^1 secured to or formed on the rotatable handle H, whereby the rotation of the handle to release it from the arc H^a produces a longitudinal movement of the bar I. The other end of the bar I is connected to a bell crank I^2 which in turn is connected by a rod I^3 with the clutch-operating bell crank I^4 shown in Fig. 1.

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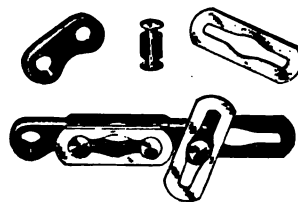
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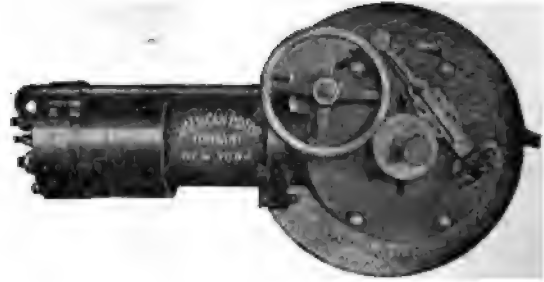
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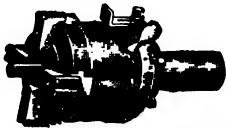
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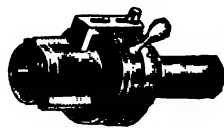
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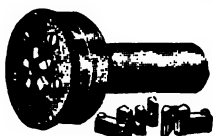
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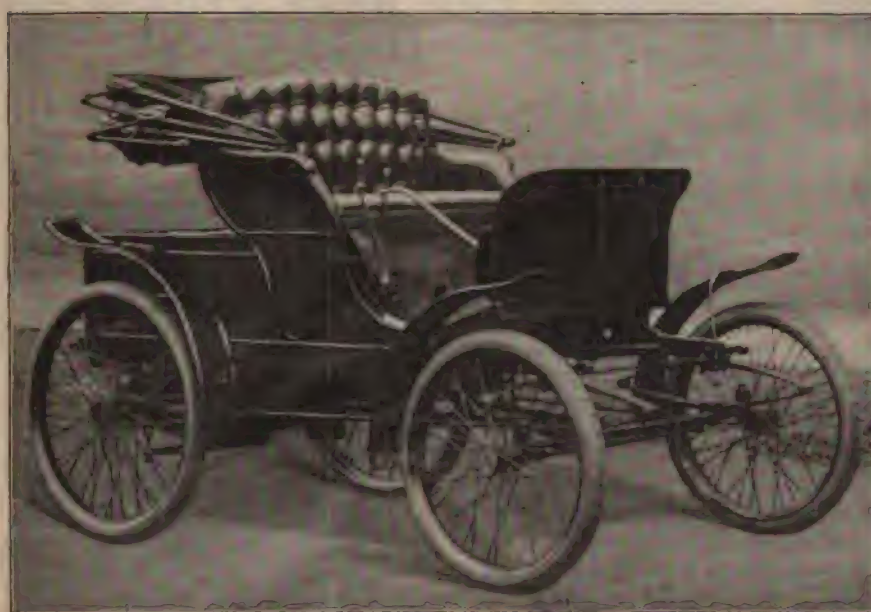
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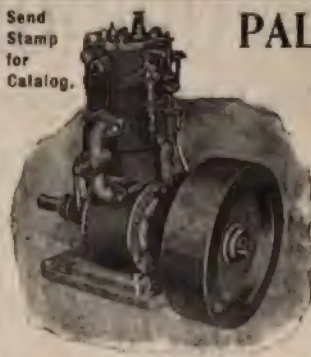
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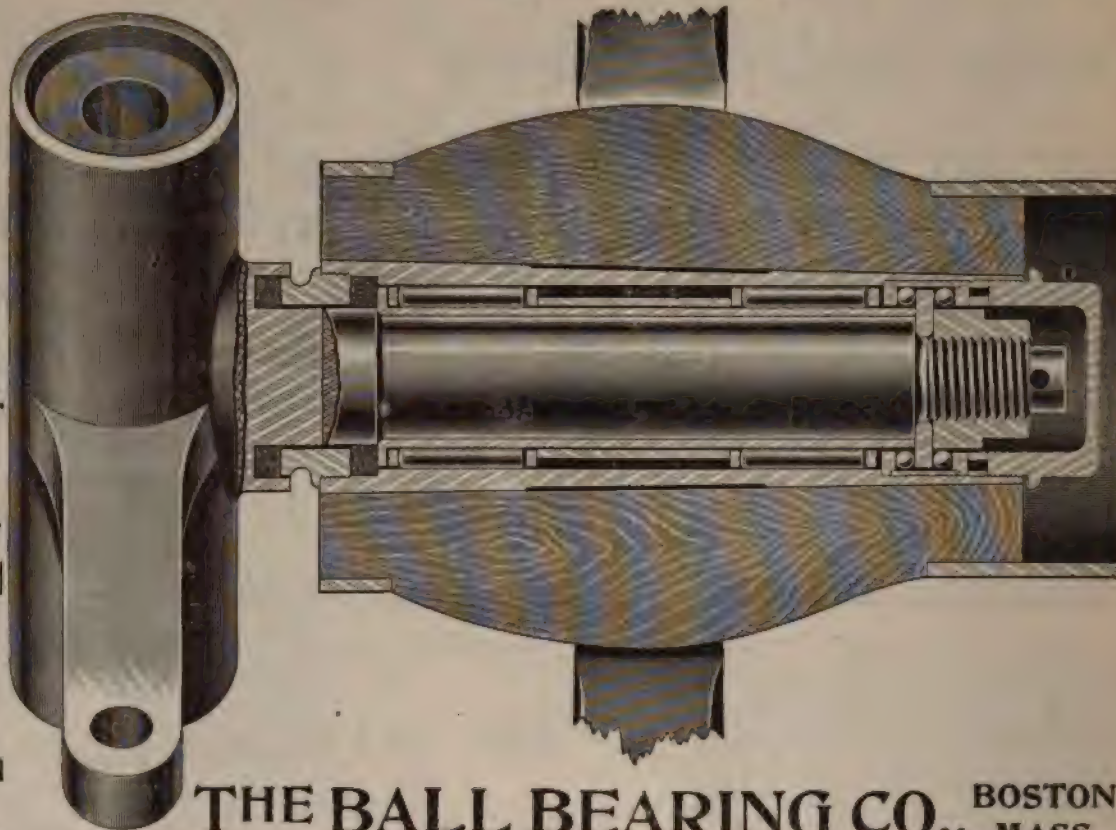
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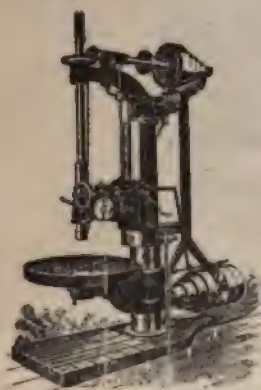


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Post Office or Express money order or N. Y. draft.**

Three-Wheelers.

Various attempts have been made both here and abroad to construct three-wheeled motor carriages that should prove as reliable on the road as four-wheeled vehicles. The saving of the differential gear and the fourth wheel and axle is a strong inducement to the inventor to adopt this form of construction. Lighter weight and lower cost, however are obtained by the sacrifice of something more important than either in a motor vehicle—stability. The three-wheeled carriage which created such a furore in Europe three years ago have been waning in popularity ever since, the light four-wheeled voiturette having displaced them in public favor. The single drive wheel has a tendency to slew on wet roads or greasy pavements, resulting not infrequently in an overturn.

The motor tricycle is a different class of machine, intended for expert riders, generally of bicycle training, who do not

object to an occasional somersault and are content to perch upon a bicycle saddle and endure the punishment of American roads. Far more than the four-wheeled carriage the motor tricycle is confined to good roads.

Wood or Wire Wheels.

The editorial paragraphs on "Wood or Wire Wheels" in our last issue have called forth a criticism, which will be found under "Communications."

The paragraphs referred to were not intended as a full exposition of the relative merits of wood and wire wheels for motor vehicles, but merely as a brief statement of reasons why some manufacturers prefer wood to wire wheels.

Mr. McCue, in his letter, says that the defects found in the wire wheels at first used on motor carriages were due to overloading and faulty construction. This is undoubtedly true, but the same may be said of the wooden wheels, whose chief faults he correctly describes. In other words, both wood and wire wheels must be specially constructed if they are to give satisfactory service in motor work. Wood wheels of horse carriage pattern and wire wheels of bicycle make are alike worthless.

As to the relative merits of the two kinds of wheels for this purpose, it seems in keeping with the widest experience to say that both may be used with advantage at present, and that the choice must depend on the weight and style of the vehicle and the conditions of the road. The wire wheel is better suited to light vehicles and good roads; the wood wheel to heavy vehicles and rough roads. The pneumatic tire is a very necessary accompaniment of the wire wheel, because it relieves it of much of the vibration; the wooden wheel is a suitable shoe for the solid tire, because it absorbs more of the vibration than the wire wheel.

It will be remembered that at the Liverpool heavy motor trials last year some metal wheels were seen, while this year

none appeared, and the accidents of the previous year were avoided. For rough roads and heavy work, therefore, it seems demonstrated that a properly constructed wood wheel is preferable.

As was stated in the last issue, however, it would not be surprising to see metal wheels of wire or other forms gradually displace the wooden as roads improve.

A Sound Legal Opinion.

The opinion of the assistant corporation counsel of New York City on the legal status of the motor vehicle, reprinted on another page, is eminently sound. It should be suitably inscribed and preserved in the archives of our automobile clubs. The disabilities under which the motor vehicle now rests are due to prejudice and custom, and must rapidly be removed as enlightened judicial opinion interprets the laws already on our statute books, for according to those laws the motor vehicle has as good a right to the highway as any horse conveyance.

In the coming days when the superiority of the motor is generally recognized, the onus of prejudice will rest upon the horse, and justly, for reasons often enumerated in these columns.

Crusade Against Reckless Motoring in France.

The news from Paris of a contemplated crusade against fast driving of motor carriages is merely the inevitable come at last. A resolution to suppress races has been introduced in the General Council of the Seine et Oise, and steps are to be taken by the chauffeurs themselves to regulate the speed of automobiles, for their own protection. It seems that a strong sentiment against the new vehicle is forming in Paris and the suburban districts on account of the reckless speeds at which motor carriages are driven, particularly by novices. The gendarmes are powerless to control the crazy chauffeurs in the city, and in the country many hostile demonstrations against offenders have been made, impediments having been placed in the roads or stones hurled at them in some instances.

Inasmuch as the orderly element must suffer for the sins of the lawless, the members of the Automobile Club are at last beginning to see the necessity of taking a stand in favor of a reasonable regulation of speed. The effect of the club's races and its acquiescence in the reckless behavior of many of its members was long ago foreseen. It would have been much better for the cause if the club had taken this stand at the outset and discouraged excessive speed. A useful lesson, however, may be brought home to this side of the Atlantic. Our own Automobile Club should profit by the experience of its precursor in France and set a better example to its mem-

bers and to the world by taking a firm position on this question of reckless driving.

A weak spot in the motor vehicle is the nuts, which are liable to work loose, owing to the excessive vibration of the road, and drop off. The loss of a nut is sometimes the cause of a serious accident, and measures should be taken to prevent it. How this may be done will form the subject of an article soon to appear in The Horseless Age.

In their eagerness to secure vehicles immediately some persons are paying for them in full in advance. This practice should be discontinued, as it is unbusinesslike, will lead to loss in some cases, and encourages weak and unstable enterprises.

On Oct. 1 Mr. R. I. Clegg will take the position of mechanical editor of The Horseless Age.

An Important Incorporation.

The United States Motor Vehicle Co. was incorporated under New Jersey laws last Friday with \$1,500,000 capital and has purchased valuable patents on both gasoline and electric systems.

The general offices of the company in the Townsend Building, Broadway and Twenty-fifth St., New York, will be occupied about Sept. 25.

The company, which has strong backing, and is under the management of able and experienced men who have been prominently identified with the central station and electric railway business, will manufacture electric and hydro-carbon vehicles of new design for both pleasure and business purposes. They have purchased T. W. McCullough's gasoline motor and motor vehicle patents (Back Bay Cycle & Motor Co., Boston, Mass.), Harry E. Dey's electric system and others.

Inquiries for McCullough motors and carriages should be addressed to the company.

Motor Mail Collection at St. Louis.

The gasoline carriage of the St. Louis Motor Carriage Co., illustrated in our last issue, was recently tested by Mr. Baumhoff, the postmaster of St. Louis, for the collection of the mail. During the day he drove the machine 75 to 100 miles, and was much pleased with its performance, collecting mails on the downtown circuit in 25 minutes that require 45 minutes by regular postal van.

In the suburban districts, where the stops were not so frequent, the saving was much greater, and the postmaster hopes to secure an appropriation for the purchase of motor vans.

The Perfect Compound Kerosene Gas & Compressed Air Automobile Fire Engine & Motor Mfg. Co. was recently organized under New Jersey laws with \$500,000 capital, to manufacture motor fire engines. The incorporators are: G. W. Draesel, Chas. A. Kunzel, Jr.; Frank Tenbert, John C. S. Kelly, Hoboken, N. J.; Wm. H. Kessler, Passaic, N. J.; Paul H. Schmidt, New York.

Evolution of the Motor Vehicle as Shown by Patents.

PART 2, THE STEERING GEAR.

By Leonard Huntress Dyer.

As mentioned in my paper on the development of the compensating gear, it is not exclusively the earlier patents that show the simple and crude attempts to overcome obstacles and reduce the inventions to practical forms, as would be supposed, but rather those of a later date, the applicants for which should have known of the efforts of the earlier patentees and been guided thereby.

This is equally true in regard to the steering gear; some patents of a comparatively early date illustrate devices that are in successful operation to-day, while others more recent embrace crude and apparently inefficient forms, which had been tried and failed, consequently were abandoned by other inventors at an early date.

The patents to be enumerated hereafter, therefore, while they will form a continuous procession in the evolution of the art, will not form a chronological sequence, as some of the perfected and complete devices are shown in very early patents.

The primitive form of motor vehicle would appear to be the three-wheeler. Leaving out of the problem the difficulty of simultaneously and differentially driving the two back wheels, which difficulty was not at first appreciated, the single front wheel could be mounted in forks and manipulated by a simple handle, wheel or tiller.

This simple construction is clearly shown in the American patent to L. W. Coe, granted Feb. 20, 1872, and numbered 123,809. In the drawing of this patent, the front wheel is shown mounted within forks in very much the same fashion as in the modern tricycle, except that a tiller is substituted for the handle bar of the present device.

This tiller must have been regarded as inefficient for the purpose, as giving insufficient power, because an independent inventor entered the field at a somewhat earlier date with a more complicated but more powerful device. This invention, patent for which was issued Feb. 7, 1871, to C. W. Hermance, and numbered 111,644, relates partially to means for increasing the purchase of the steering handles. The single front wheel is mounted upon forks which are provided with a horizontal toothed sector. A vertical or nearly vertical steering pillar, carrying handles at its upper end and provided with a pinion at its lower extremity, is used. The pinion engages with the toothed sector and produces a powerful and simple steering device.

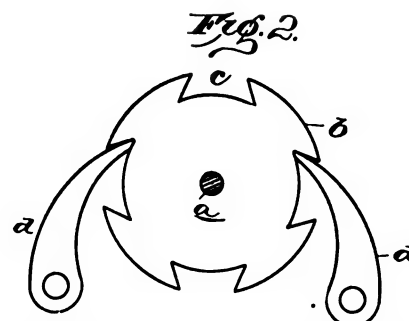
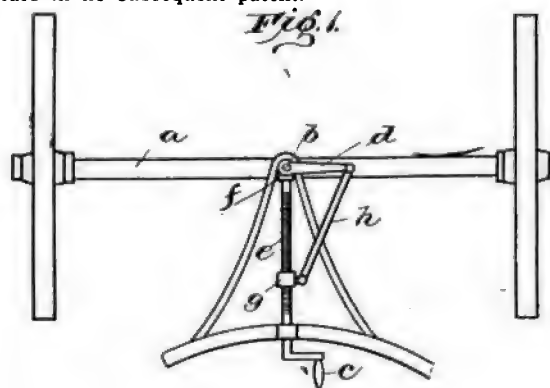
A somewhat neater device for accomplishing the same purpose appears in the patent to C. H. Warrington, Nov. 30, 1880, No. 235,051, which shows a single steering wheel mounted upon forks and provided with a short lever at right angles to the carriage. This is operated by means of a horizontal link. The link has formed thereon a toothed rack, which engages with a pinion on the steering pillar. The latter carries the operating handles.

A means of doing away with the fork is shown in the patent to J. B. McKinley, No. 111,761, of Feb. 14, 1871, having a single wheel mounted upon a turntable which is rotated by means of links connected to the steering handle. This patent is of interest as showing an attempt to drive with the front wheel, the engine being vertical and supported upon the turn-

table, and connected directly to the front wheel by means of cranks and connecting rods.

In the above device but little leverage or purchase can be secured for turning. An improvement is shown in the patent to J. M. Lauck, No. 183,177, dated Oct. 10, 1876, which shows the single steering wheel mounted on a turntable, the periphery of which is grooved and admits of the application of a rope or chain. The latter is manipulated by being secured to a drum of less diameter than the groove. The drum is carried upon the lower extremity of the steering pillar.

At an early date four-wheeled motor vehicles are shown and described in patents. These either consisted of two sets of wheels arranged side by side, as in the modern practice, or of two driving wheels side by side, with the steerer in front and a caster wheel trailing behind. This latter arrangement is shown in the English patent to Clark, May 18, 1869, No. 1,519, but was apparently abandoned at an early date, as the idea appears in no subsequent patent.



The idea of steering by pivoting the front axle at the center and twisting it bodily from side to side has been very elaborately developed. As with the single steerer, a lever or tiller connected directly to the axle would seem to be the simplest device. This forms the subject matter of the patent to S. E. Worrell, granted Aug. 10, 1886, and numbered 346,974.

It was early seen that means should be provided for turning the front axle with certitude and facility irrespective of the resistance at the moment encountered. One of the simplest constructions is to use a rope and tackle connected either to the axle or to a tiller attached thereto, or to a tiller secured to a vertical standard. This forms the subject matter of the patent to S. B. Stone, granted Aug. 15, 1876, No. 181,220. The steering pillar is provided with a drum, to which is attached the hauling part of the two tackles which connect the body of the carriage to the extremities of the front axle.

An improved construction is shown in the patent to J. K. Fisher, No. 1,987-32,991, of Aug. 6, 1861, which is very simple

and ingenious. As this device might be used upon vehicles at the present day, without great modifications, a top view is illustrated herewith in Fig. 1.

In this invention the front axle *a* is rigidly attached to the kingbolt *b*, which extends upward to about the height of the steering handle *c*, and passes through a bearing attached to the front part of the carriage body. The kingbolt carries at its upper extremity a single lever, *d*, which extends for a short distance to one side. A horizontal shaft, *e*, connects the front of the vehicle with a bearing, *f*, adjacent to the upper extremity of the kingbolt. The shaft is screw-threaded and has a nut, *g*, which travels thereon. The nut is connected by means of a link, *h*, to the outer extremity of the lever *d*. The rear end of the shaft is provided with a crank, *c*, by means of which it may be rotated and the nut moved back and forth to effectively and positively turn the lever *d*, and consequently the front wheels, and lock them in any desired position.

A more powerful device is shown in the patent to F. Alger, No. 115,802, June 13, 1871. In this patent the front axle is shown as being moved by a chain or rope which passes around a small drum turned by means of a system of endless screws and bevel gears. In this invention the steering shaft or pillar is vertical, but is provided with a universal joint near the floor of the vehicle, so that it may be swung out of the way when passengers are getting in or out.

In a great many patents the front axle is turned by providing a horizontal gear immediately below the fifth wheel. This gear is internally geared, as is shown in the French patent to Denton, No. 4,210, Dec. 4, 1829; or is externally geared, as in the patent to D. H. Ball, No. 139,997, June 17, 1873. In these various patents the vertical steering pillar carries at its lower extremity a pinion which engages with the gear wheel.

A gear having an endless screw will automatically lock itself in any desired position, but a device consisting of drums or gears and pinions will not lock unless special means be employed for that purpose. This forms the subject matter of the two following patents. The first, to I. A. Sabin, No. 104,888, dated June 28, 1870, shows a horizontal tiller, which works over and presses upon a fixed serrated rack or sector, the teeth of which are separated a sufficient distance to allow the tiller to drop between any adjacent two and to be rigidly held against sidewise movement. The tiller is released by lifting it clear of the teeth of the sector. The other patent is that of N. B. Baldwin, No. 120,846, dated Nov. 14, 1871, a sketch of a part of which is shown in Fig. 2, which represents a top view of the bottom of the steering pillar. The latter is shown in sections at *a*, and is supposed to connect with the front axle in any suitable manner; in this instance by a drum and rope. The gear *b* is provided upon its periphery with four or more notches, *c*, with which engage the two dogs *d*. Either of the latter may be disengaged by the operator when he desires to turn the shaft *a*.

Some attempts have been made to use the power of the engine to steer. There are two ways of doing this. The first form embraces mechanical connection between some moving portion of the vehicle, as the engine shaft or the wheels, and some forms of steering, as before described.

The patent to C. D. Monnot, No. 197,485, Nov. 27, 1877, is of interest as showing one of the first attempts to do this. In this construction the front axle is turned by means of a worm on a short shaft. This shaft may be turned in either direction by means of two ropes which pass in opposite directions around separate drums. The ropes connect at their outer extremities with two other drums, supported upon two shafts

which constantly revolve, and connected thereto by means of spring disengaging clutches. Means are provided for engaging either clutch at pleasure, thus powerfully and quickly turning the front axle. A modification of this form, which was never carried out to very great elaborateness, shows another way to turn the front axle by means of power from the engine. This consists in using a pilot wheel, which rests upon the ground either in advance or in the rear of the front axle, and which may be easily turned and yet will exert great power to twist the front axle. The English patent to Rawes and Boase, July 19, 1830, No. 5,956, shows this idea very well developed. In this device the pilot wheel is in the rear of the front axle; in fact, is almost under the middle of the vehicle. It is connected by means of the tiller rods to the steering handle.

(To be continued.)

Suggestions in Automobile Design.

By F. W. Tucker.

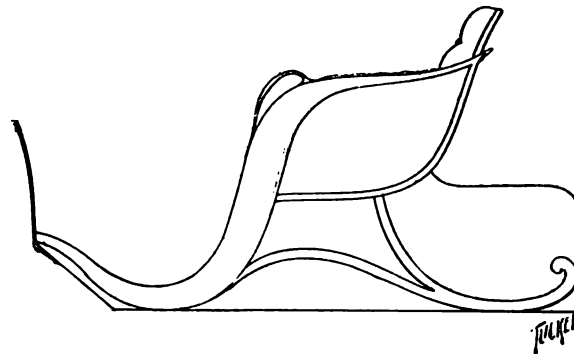
In view of the fast increasing use of automobiles and a demand for better and more varied styles, we have made arrangements with a well-known carriage designer, F. W. Tucker, of Boston, to supply us with studies, drawings and details suitable for motor vehicles. These will not be drawn with any particular style of motor or means of propulsion in view, but will serve as suggestions which builders may elaborate and adapt to their own particular system. Mr. Tucker will be glad to receive suggestions from motor vehicle manufacturers, which may be helpful to him in his efforts to improve the form and appearance of the automobile.

A SPYDER WAGON.

This wagon is intended for a high-grade vehicle, and is especially adapted from the similarity of its lines to a spyder, to the use of ladies. Its shape is made up of a series of graceful curves.

The frame work on the sides, which in a spyder forms the back hangers or body loops, is in very bold relief.

A three-bow top, either with a close hood or curtain sides, would add much to its appearance. In painting use three shades of the same color; the lightest on the pillar or snake-like panel in front, the next darker on seat panel, and the darkest on the frame work.

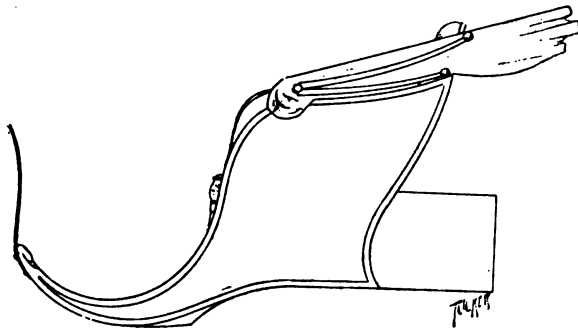


Paint the flat panels black. Stripe the edges of all moldings and frame work.

If to be used without a top, trim with whipcord. If with a top use broadcloth.

GENTLEMAN'S BUGGY.

This will make a very comfortable carriage, stylish and dignified; and although it has high side panels is not unnecessarily heavy.



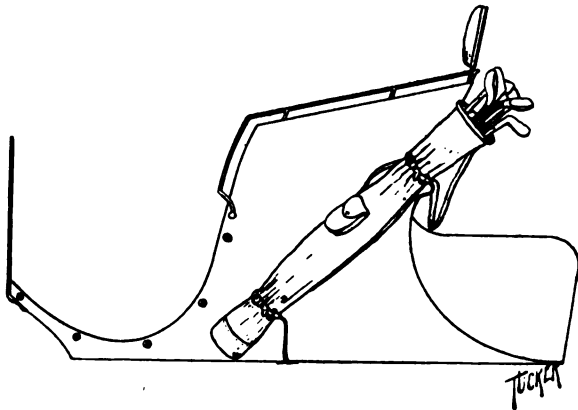
A three-bow close hood, with single side joints, will look best on this body.

Paint large panels a rich maroon; moldings black, striped with carmine; flat panels black. Trim with broadcloth to match or a very light drab.

THE GOLFER.

A thoroughly up-to-date wagon, to be used as the drawing would indicate, for transportation to and from the links; or, with the caddy bags removed, for any sort of pleasure riding.

This wagon would be to the ordinary motor wagon or surrey what a hackney is to a family driving horse. Its name is quite appropriate, as its appearance is very striking, the side panels sweeping boldly out at the top like the back.



The body should be painted entirely black, without striping. The gear may be painted either light English vermilion or carmine.

Trim with pigskin or very broad wale Bedford cord of a light cream color. If the owner is a golf enthusiast—and what golfer is not?—the trimming may be of green silk plush or heavy velvet to match coat collars and lapels.

The five round spots shown in the drawing are very large English knobs to fasten the waterproof boot, and are the proper thing.

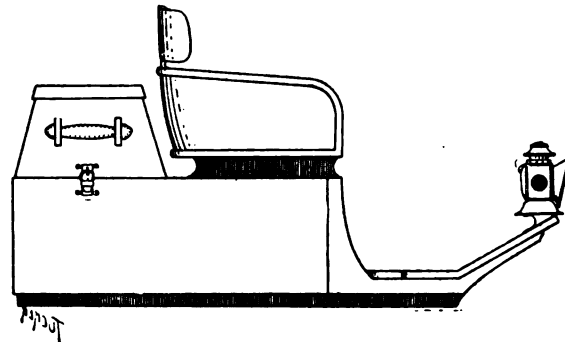
A TOURING CAR.

While called by the above title, a carriage built on these lines would be suitable, with the imperial or lunch box left off, for any other purpose.

The perpendicular lines give it a very chic appearance, while the absence of spindles, blinds and medallions adds to its richness.

The seat is close-paneled, with full round corners.

It is made very roomy and overhangs the side of the body proper. The footboard is wide and carried back its full width to the heelboard.



The Imperial is easily removed, and by placing a seat in its stead, using the tail gate for a footboard, a very stylish dos-a-dos trap is made.

Paint the seat panel, front pillar and bracket a deep green or blue; molding and flat panels black; seat riser and sunken sill a light English vermilion or ruby carmine. No striping. Trim with whipcord or Bedford cord.

Paint Imperial black or cover with black neat's or enameled leather, and russet straps. This carriage would be in best form to have wooden wheels, with solid or cushion tires. Paint gear and wheels same color as seat riser and have no striping.

A Wise Corporation Counsel.

The only municipal act relating to the operation of motor vehicles in New York City was passed in 1897. It empowers the Mayor to license "for hire, horseless coaches, carriages and cabs designed for propulsion by electricity supplied by an electric storage battery or batteries."

It will be noticed that the act refers only to electric vehicles, as the only company which applied for a license at that time was the Electric Vehicle Transportation Co., and this company naturally had no objection to the restrictive character of the law.

Last January one of the City Councilmen introduced a resolution asking for the appointment of a committee to draft an ordinance licensing and restricting the use of automobiles.

It was proposed that motor inspectors and examiners be appointed and operators examined for certificates before being permitted to run motors in the streets. This resolution is now lying in abeyance in the Law Committee of the Council.

Speaking of the status of the horseless vehicle, Assistant Corporation Counsel O'Neil said recently to a representative of the New York Herald:

The automobile as a practical vehicle operated in the street naturally comes under the operation of the common law principles, statutes, ordinances and regulations which govern

the conduct of other vehicles. The automobile having been demonstrated to be a manageable vehicle, I am not aware of any ground upon which it can be lawfully excluded from any public street or road.

The obligations and liabilities of an automobile driver are the same as the drivers of other vehicles. He must exercise due prudence, caution and care, and he is liable to a suit for damages in any case of injury to person or property in which culpable negligence can be proved against him.

I do not think that the driver of an automobile would be liable for damages in the event of injury to the person or property of another resulting from the action of a horse which had been frightened by an automobile unless the fright had been caused by some wholly unnecessary or wanton motion intentionally imparted to the vehicle by the driver.

It is practically certain that wherever the automobile has been discriminated against by executives or by law makers it has been without sound warrant in reason or justice, and that eventually the automobile must escape from all disabilities of that kind.

The Squier Steam Carriage.

W. E. Squier, Virginia City, Nevada, is the designer and builder of a steam carriage which has some points of interest.

The boiler is made of mercury flasks, and easily supplies the engines with dry steam at 200 lbs. pressure. Its weight is about 120 lbs. Gasoline is used for fuel, being stored in a tank under the body.

The engines are two in number, one for each drive wheel, and are entirely separate from each other. The cylinders are $2\frac{1}{4}$ and the stroke $3\frac{1}{2}$ inches. The gearing is 6 to 1, and steering is by means of a fifth wheel.

An interesting feature is the round belt transmission, which is said to work very well.



SQUIER'S STEAM CARRIAGE.

MINOR MENTION.

The Woods Motor Vehicle Co. are exhibiting at the Pittsburgh Exposition.

The Barnes Cycle Co., Syracuse, N. Y., have completed a light electric carriage for two.

The American Electric Vehicle Co., Chicago, Ill., have opened a New York office at 21 Park Row.

The big cracker concern making the well-known Uneeda biscuit are adopting electric wagons for the delivery of their goods about Boston.

Frank Aldrich, of Oneida, N. Y., formerly vice-president of the American Tire Co., New York, is said to be about to start a motor vehicle company at Oneida.

The American Automobile Co., which was considering a lease of the Warwick bicycle plant at Springfield, Mass., is now said to be looking favorably upon a location at Marlboro, Mass.

C. B. Thompson & Co., Charles Scholl and local capitalists have incorporated the United States Automobile Co. at Milwaukee, Wis., with a capital of \$500,000, to manufacture gasoline and steam motors and vehicles.

When F. E. Stanley returned from Europe recently he brought with him orders for 400 Stanley No. 1 automobiles. This company will soon have ready a four-passenger vehicle of similar design to their two-passenger Stanhope.

The Mercantile Mfg. Co. is a recent New Jersey corporation, with \$100,000 capital, which proposes to make motors and motor vehicles. The incorporators are Chas. E. Stout, Brooklyn, N. Y., and James S. Nathans and Wm. H. Gale, New York City.

The stock and materials belonging to the National Motor Carriage Co., New York, lying at Tuttle's machine shop, Stamford, Conn., have been attached by creditors, including employees. The National Co. was interested in the Davis Transcontinental Tour.

Among new incorporations is the English Automobile & Motor Co., of Chicago, to make and sell rotary engines, automobiles, etc. The capital is \$5,000,000 and the incorporators are P. English, of Benton Harbor, Mich; T. M. Moe, A. E. Ross, F. A. Loomis and F. English, all of Chicago.

Liquid Air Prospectus.

The Liquid Air Power & Automobile Co., recently organized at Boston, Mass., has purchased a factory 50 x 200 ft. at Cambridge, Mass., corner Massachusetts Ave. and Albany St. The company claims to have a very economical process for manufacturing liquid air, and to be able to build vehicles run by this power, weighing less than 300 lbs., fully equipped for a run of 100 miles.

The company also claims to be able to revolutionize nearly everything in the line of power.

MACHINERY and TOOLS for motor vehicle builders

Readers using information from this department are requested to give credit.

IV.—Lathe Arithmetic.

By Robert I. Clegg.

One of the first things the lathe man should acquire is a knowledge of the several screw pitches on his machine tool and the arithmetical processes involved in such calculations as appertain to all round lathe work. Often the workman is content if he knows the pitch of the lead screw, but he will find it useful in drilling and boring, as well as ascertaining the depth of a center hole, to know also the pitch of the screw in the tailstock; and the same applies to the cross feed screw in an even more important sense because of the greater opportunities for usefulness; knowing the pitch we tell how much we are reducing the work in the lathe by noting the number of revolutions or part of a revolution that we have turned the handle on the cross feed screw. So well has this convenience been recognized in recent years by machine tool builders that quite frequently the hub of the handle is divided around the circumference, so that minute distances traversed by the tool are easily read. It is an easy matter, however, if this has not already been done, to remove the handle and divide the hub into the appropriate number for that particular pitch of screw, with the aid of a gear cutter, or milling machine, and a sharp angular mill. A reminder must be put in here to the effect that the distance moved by the tool affects the radius of the work by exactly that amount and that the effect of the same amount upon the diameter is of course doubled.

SETTING THE LATHE IN LINE.

To set the lathe for straight work take a piece of shafting, drill and ream centers and square up the ends; then turn down near the lathe dog at headstock a place about an inch long, slack back the tailstock spindle, remove the shaft, without moving the relative position of the cutting tool, bring the carriage back to tailstock, replace the work in lathe and take a chip off the end for about the same distance as before without altering the tool as originally set for the other cut. Caliper the two diameters; if both are the same, then the alignment of lathe is all that is desired; if, on the contrary, the two dimensions fail to correspond, then the tailstock must be moved over the distance to correct the inequality, and a second chip is taken off the shaft and the whole process repeated. The shaft should be preserved, and at any future time the lathe centers can be brought into line by placing the shaft in lathe, put a flat-ended piece of steel in tool post—a cutting tool, blunt end, to work is most suitable—an inside caliper or any similar means being used to test the distance of the places on the turned shaft from the tool post. A careful lathe man will set the tailstock until a strip of thin tissue

paper will have the same "nip" or resistance when pulled between the shaft and the tool at each turned place.

AN ALIGNMENT KINK.

The tailstock is held in alignment by two screws, which are tapped into the box frame, resting on the "vees" of the lathe, and the points of these screws abut against a projection cast upon the upper sliding part of the tailstock. Now it is evident that for any one taper only one of the screws need be moved to have the lathe center set over to the back or the front of the machine, as that particular taper shall require. Hence in my own practice I have left one screw untouched, so that after taper has been turned the slide could be pushed back into position and the other screw brought into contact with the abutment without loss of time for straight work.

RULE FOR TAPERS.

The turning of tapers is a common operation; connecting rods, axles, valves and cocks, etc., are in this class of work, and where the Slade taper turning attachment is not applied to a lathe some rule for setting over the lathe center comes in very useful. The rule here given is taken from the American Machinist. No rule can be given which will produce exact results, owing to the fact that the centers enter the work an indefinite distance. If it were not for this circumstance the following would be an exact rule, and it is an approximation as it is:

To find the distance to set the center over: Divide the difference in the diameters of the large and small end of the taper by 2, and multiply this quotient by the ratio which the total length of the shaft bears to the length of the tapered portion.

For example: Suppose a shaft 3 ft. long is to have a taper turned on the end 1 ft. long, the large end of the taper being 2 in. and the small end 1 in. in diameter. Then

$$\frac{2 - 1}{2} \times \frac{3}{1} = 1\frac{1}{2} \text{ inches. Ans.}$$

PIPE THREADS.

The standard United States taper for pipe taps is $\frac{3}{4}$ in. to the foot; that is equal to an included angle of 3 deg. 35 min. The threads per inch of wrought iron pipe are 1-8 in. = 27ths, 1-4 and 3-8 in. = 18ths, 1-2 and 3-4 in. = 14ths, 1 to 2 in. = 11½ths, over 2 in. = 8ths. It has been pointed out that if the end of the threaded pipe has a less amount of taper than the fitting, or the tap, a much tighter joint can be made with the same strain, and for motor vehicle work, where the pressures are high, material of light weight and subject to rough usage, the kink is well worth noting. The angles of threads, as well as lathe centers, are the same, viz., 60 deg.

In setting a thread tool to cut a tapered screw on a pipe or tap the tool should be set at right angles to the axis of the piece and not to the turned surface of the tapered part of the work.

LATHE GEARING.

This rule for gearing lathes for screw cutting is given by the Garvin Machine Company. Read from the lathe the index, the number of threads per inch, cut by equal gears, and multiply it by any number that will give for a product a gear on the index; put this gear upon the stud, then multiply the number of threads per inch to be cut by the same number, and put the resulting gear upon the screw.

Example: To cut $11\frac{1}{2}$ threads per inch. We find on the index that 48 into 48 cuts 6 threads per inch; then $6 \times 4 = 24$ gear on stud, and $11\frac{1}{2} \times 4 = 46$ gear on screw. Any multiplier may be used so long as the products include gears that belong with the lathe. For instance, instead of 4 as a multiplier we may use 6. Thus, $6 \times 6 = 36$ gear on stud, and $11\frac{1}{2} \times 6 = 69$ gear upon screw.

It will be some help to the memory to get into the habit of forming a fraction mentally of the process, thus: Taking the same example,

$$\begin{array}{l} \text{Threads cut by equal gears,} \\ \text{Threads to be cut,} \end{array} = \frac{6}{11\frac{1}{2}} = \frac{12}{23} = \frac{36}{69} \quad \text{Ans.}$$

By forming the fraction thus the numerator goes on the stud and the denominator on the lead screw; I bring the odd pitch to a whole number first, for that is much the easier way to handle mixed numbers in mental arithmetic, and it is then simple to double or triple the result, to suit the gears provided for that lathe.

LATHE SPEEDS.

The speed of countershaft of the lathe is stated by Mr. W. Kent to be determined by an assumption of a slow speed with the back gear—say 6 ft. per minute on the largest diameter that the lathe will swing. Example: A 30-in. lathe will swing 30 in. = say 90 in. circumference = 7 ft. 6 in.; the lowest triple gear should give a speed of 5 or 6 ft. per minute. The relative speeds of line shaft and countershaft are as diameters of their pulleys, and being in possession of any three of these factors we can easily determine the fourth. For example: Multiply the diameter of the pulley on countershaft by its number of revolutions and divide the product by number of revolutions of line shaft. Quotient will be diameter of line shaft pulley. Multiply the diameter of pulley on line shaft by number of its revolutions and divide the product by number of revolutions of countershaft. Quotient will be diameter of countershaft pulley.

Multiply diameter of pulley on line shaft by its number of revolutions and divide the product by diameter of pulley on countershaft. Quotient equals number of revolutions of countershaft.

In the proceedings of the Ins. M. E., 1883, it is shown that if the cutting speed exceed 30 ft. per minute so much heat will be produced that the temper will be drawn from the tool, and it is recommended that the average cutting speed for wrought or cast iron should be 20 ft. per minute, whether for the lathe, planing, shaping or slotting machine. See also Kent's Pocket Book.

As the feed and condition of tool, etc., are most likely influential factors in the determination of the best average speed very probably the feed approached the maximum amount; the speed would doubtless be increased in everyday practice without passing the danger point where excessive heating takes place. Following this line, the writer would suggest 26 ft. per minute as lending itself readily to mental calculation, and at the same time be within practical limits. Now 26 ft. per minute is about equal to the circumferential velocity of a 1-in. shaft at 100 revolutions per minute. Then to get the revolutions per minute for any size of work simply divide the diameter into 100. Thus a 5-in. shaft, $100 \div 5 = 20$ revs. per min. A $\frac{1}{2}$ -in. shaft = 200 revs., and so on.

COMMUNICATIONS.

Defends the Wire Wheel.

Hartford, Conn., Sept. 1.

Editor Horseless Age:

Your article on "Wood or Wire Wheels" is certainly misleading and does great injustice to wire wheels.

The facts are that when wire wheels are properly constructed they are superior in many ways to the wood wheels for every purpose, and the trouble with the wire wheels heretofore used on many motor vehicles was wholly due to their construction and being overloaded. More than 99 per cent. of the first horseless vehicles built were anywhere from two to ten times as heavy as the promoters started out to build, and they not only used tires too light for the load they eventually carried, but they used springs, axles and every other part which entered the construction of the vehicle entirely too light for the purpose.

You say that the wood wheel is best adapted to the present condition of roads because it absorbs vibration and will not yield so readily to lateral strain. The facts do not justify that statement. The wood wheel is in good condition but once, and that is immediately after it is finished (then only sometimes), as it is immediately affected by wet and dry weather, and is out of true every day of its life; in fact, it is impossible to true a wood wheel, for if you true it by the hub the rim is out, and if you true it by the rim the hub is out, and if you have looked over one million wood wheels on carriages and spun them on the axles you have never seen one which will run absolutely true, and none of them would stay true if they were in that condition. The best evidence in the world that this is so is the fact that every one who has bolted a gearing to wood spokes has soon changed because it would not mesh properly on account of the wheel getting out of true in short order; on the other hand, a wire wheel can be made perfectly true, and as it is never affected by wet or dry weather, it will stay in that condition.

You say that another advantage that is found in the wood wheel is the ease with which it can be washed, and that the wire wheel is very apt to rust when water is applied. You are evidently not familiar with the wire carriage wheel or you would not have made that statement. All wire wheels should be painted, and when painted they will not only not rust, but they can be easily washed. They will also remain in better condition longer than any other style of wheel, because they are not affected by the weather. With pneumatic tires they will last longer, present a much better appearance and the vehicle will run very much easier, because the hub and wheel can be made absolutely true and kept in that condition.

Yours very truly,

PREMIER MFG. CO.,

C. T. McCue.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

LONDON NOTES.

CONTROL TESTS FOR HEAVY MOTOR WAGONS.

London, Aug. 24.

The trials in connection with the proposal to increase the legal speed limit of heavy motor wagons in England were carried out at Richmond, S. W., on Friday, the 18th inst. Four vehicles put in an appearance—a Thornycroft steam lorry, the Clarkson-Capel steam lorry which lately made the journey from Liverpool to London with a full load, Bayley's large gasoline omnibus and one of the large P. O. gasoline vans of the Daimler Motor Co. The vehicles were subjected to a number of evolutions in the presence of the local government board's official chief, among the tests being one to determine the quickness with which the vehicles could be brought to a standstill when going at a good speed, both on the flat and down hill. Some very good performances were recorded. Thus the Clarkson-Capel wagon, which, loaded, weighed 5 tons 9 cwt. 1 qr. 20 lbs., when traveling at $8\frac{3}{4}$ miles per hour was pulled up after an unexpected signal on the flat in 4 2-3 yds. While going down a gradient of 1 in $10\frac{1}{2}$ at $9\frac{1}{2}$ miles per hour, the vehicle was stopped in 6 1-3 yds. Equally creditable work was done by the drivers of the other vehicles.

THE DAIMLER OMNIBUS.

The Daimler Motor Co., Ltd., of Coventry, have lately turned out a large vehicle in the shape of a hotel or railway omnibus. The vehicle is of the covered type, and has accommodation for fourteen persons. The motor is a 4-cylinder Daimler, giving 12 h.p.; it is located in front as is usual in the vehicles of this company, the only deviation from the standard frame being the employment of a cranked rear axle to allow the wheel to be dropped between and so permit of the bottom of the 'bus being brought close to the ground. Four speeds forward, ranging from $3\frac{1}{2}$ to 14 miles an hour, are provided, as also three independent brakes. The 'bus has vertical wheel steering and wooden wheels, shod with solid rubber tires.

ACTIVITY IN THE CYCLE DISTRICTS.

An increasing amount of attention is being devoted to horseless carriages in the cycle manufacturing districts in the Midlands. I have in previous letters alluded to the firms which have already taken up the construction of motors and cycles, while now I learn that the Alldays & Onion Engineering Co., of Birmingham, have one or two new types of carriages in hand. The Allard Cycle Co., Ltd., of Coventry, which has been making motor tricycles for some little time past, is also now engaged on the construction of a four-seated carriage, while at the works of the New Courier Cycle Co., of Wolverhampton, a new motor carrier tricycle is at present on the stocks.

WORK OF THE AUTOMOBILE CLUB.

The question is being asked over here as to the progress that is being made with the constitution of the Automobile Club of America. If any doubt exists in American automobile circles it should be dispelled by an appreciation of the large amount of serious and useful work which the Automobile Club of Great Britain has at present in hand. The secretary has this week issued a circular in which it is stated that:

The committee have now under consideration the following matters. Special committees will meet and press forward

with these matters as soon as the summer vacation is terminated:

1. Recommendations to the Local Government Board as to amendments in the regulations of the Board affecting light locomotives on highways.
2. The formation of a society for protection against vexatious prosecutions and vexatious actions at law.
3. The organization of a race for touring and racing carriages in France next spring.
4. The organization of the Second Automobile Club Show, to be held from or about March 24 to April 7 next.
5. The framing of rules affecting automobile racing.
6. The representation of British manufacturers at the Paris Exhibition of 1900 and at other exhibitions.
7. Arrangements for the accommodation of members of the club who may be visiting the Paris Exhibition of 1900. It is proposed to rent a small villa near Paris.
8. The compilation of an accurate list of motor spirit stores, repairing firms, etc.
9. The compilation of a small pocket book giving useful information of a non-technical nature.
10. Arrangements whereby manufacturers or members may at any time submit motor vehicles to trial, and obtain a club certificate as to their capabilities.

Surely the sooner an association of a similar kind gets to work in the United States, the better it will be for the American movement.

To the list of the many English builders of heavy steam wagons has now to be added the Verity Motor Co., of East St., Bradford, York, this concern having lately produced a vehicle of that type. The body, which is of the blast type, is constructed to the firm's own designs and is located in the fore part of the wagon. Coke is used as fuel, the working steam pressure being 250 lbs. per square inch. The wagon is provided with two speeds— $2\frac{1}{2}$ and 5 miles per hour.

The Steam Wagon & Carriage Co., Ltd., of Cheswick, S. W., in consequence of the increasing demand experienced for its Thornycroft steam wagons, which secured the gold medal at the recent heavy motor trials at Liverpool, is just on the point of completing large new works at Basingstoke. The principal shop measures 140 x 120 ft., and is at present being equipped with machine tools of both English and American construction.

An interesting feature of the present shooting season in Scotland is the use which is being made of motor vehicles in conveying parties to and from the "shoot." One of the inconveniences of the horse vehicle in this respect is that a good deal of time is taken up in arranging for the accommodation of the horses during the day, while the motor wagon can, if necessary, be left on the side of the road all day long and be ready for work on the return of the party.

Following the Whitney, a Stanley steam carriage has this week reached England in charge of H. N. Searles and President Barber, of the Locomobile Co. of America.

Five electric cabs have been examined and licensed by the Berlin police, and by September will be at the service of the public. The batteries have a capacity of 18 miles on one charge, and the maximum speed of the vehicle is about 10 miles an hour.

Several English motorists, among them S. F. Edge, have had the lever steering on their French carriages changed to wheel steering, which they regard as easier and safer.

The Société de l'Alkolumine, 32 Ave. Raumesnil, Amiens, France, recently exhibited an experimental vehicle driven by an alcohol motor, which has been patented in several European countries. According to the inventor, M. Martha, the cost of operation is reduced to 24 centimes per horse-power hour, and the motor gives very little odor and vibration.

OUR FOREIGN EXCHANGES.

The Pernoo Motor Bicycle.

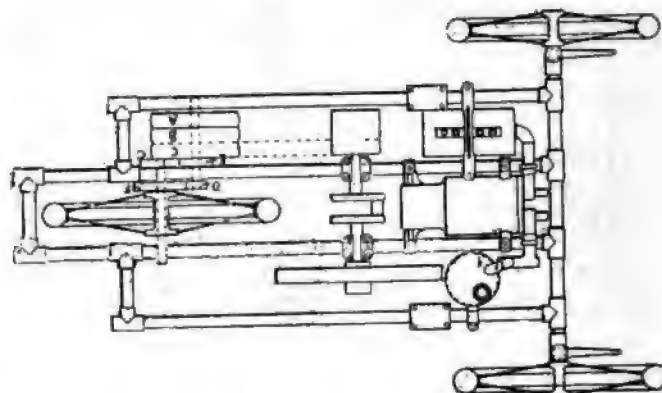
Petroleum motor bicycles are rapidly multiplying in Paris, according to La Locomotion Automobile. One of the latest is the Pernoo, in which the vertical motor is placed behind the rear wheel. There is nothing except the sparking battery to load the machine down or interfere with the movements of the rider. The pedals are the same as usual, serving merely as foot rests after the machine has been set in motion. An ingenious disengaging device on the rear axle prevents the chain and cranks from moving while the machine is in operation. Special rims and heavy pneumatics are used for safety.

The motor employed, known as the Labitte, weighs about 17 lbs., and is rated as 1 h.p.

Two levers suffice for control, one for the carbureter, the other for the ignition.

A belt to the rear wheel transmits the power.

Gasoline sufficient for a run of 60 miles can be carried in the tank, and the battery will furnish current for several thousand miles. A speed of about 25 miles an hour is claimed.



Generally the belt is on the idle pulley B, the position of rest. If the belt is brought in contact with the pulley A a slow speed is obtained through the gears E C. When the belt engages the pulley C a speed of 18 miles an hour is secured by means of the gears D F. The intermediate speeds between 9 and 18 are obtained by varying the ignition.

The gasoline tank behind the seat holds 25 liters. Two brakes are provided.

The weight of the machine is 500 lbs.

The Serin Voiturette.

The Sérin voiturette, herewith illustrated, is said to be remarkable for the facility with which it surmounts steep hills. It has only three wheels, like the Bollee, which it resembles somewhat in general design, says La Locomotion Automobile. The motor is horizontal and develops 4 h.p. at 800 revolutions. Ignition is electric, and a water jacket is employed. It is placed forward near the front axle, and is close to the ground.

The cooling water is circulated without the aid of a pump by the common principle of the thermo-siphon, the water tank curving over the rear wheel like a mud guard.

Transmission from the motor shaft to the rear wheel is accomplished through a long belt placed laterally and giving two speeds.

The Creanche Electric Carriage.

Simultaneously with the light gasoline voiturettes light electric carriages are appearing in France. La France Automobile, in a recent issue, describes the Créanche, which took part in the recent race for electric carriages in Paris.

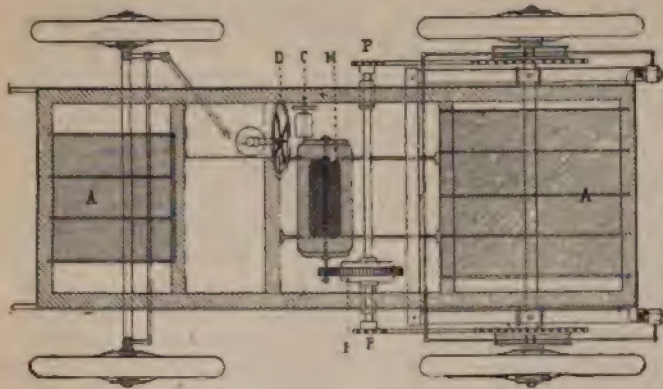
The general design of the vehicle is that of a duc. The frame, which is rectangular, is constructed of wood and iron.

The 4 h.p. motor transmits direct to the differential shaft, at the ends of which are pinions and chains communicating with the rear axle. The frame rests upon four springs; the motor is supported by anti-vibrating springs.

All the changes of speed—starting, reversing, braking on the motor and on the differential—are obtained by means of a small handle at the operator's right, governing the controller.



PERNOO MOTOR BICYCLE.



In addition to the two electric brakes there is a third brake for emergencies, acting upon the rear wheels. To prevent disaster on an ascent from failure of the brakes a prop is provided.

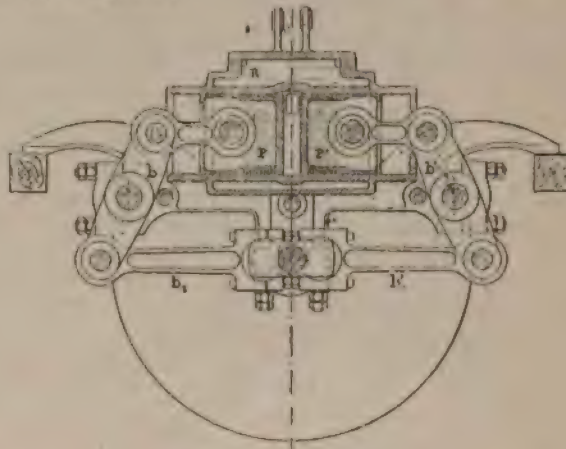
The batteries consist of forty-four cells arranged in two groups—forward and back—the cells being placed in seven different boxes for ease of handling. The boxes slide in grooves and are so arranged that they can easily be inspected.

At a fifteen ampere discharge rate the batteries will last four hours. The consumption of current on the average is ten amperes at 90 volts.

The Koch Kerosene Motor.

The only vehicle in France operating with ordinary kerosene oil is the Koch, made in Paris. According to La France Automobile, the motor is so perfectly balanced that there is scarcely any vibration, even when the vehicle is standing still.

No carbureter is employed, avoiding the constant regulation for temperature.



KOCH KEROSENE MOTOR.

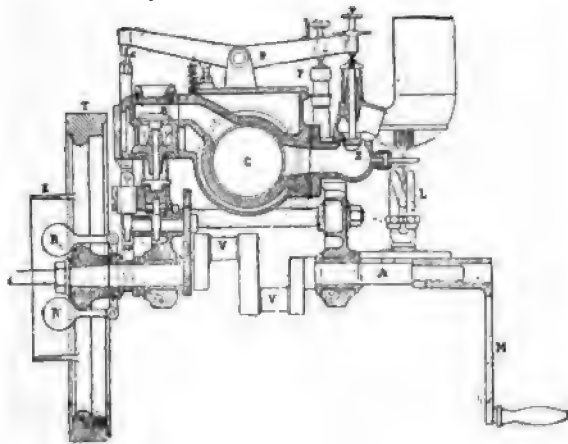
The motor is of the Otto cycle and has but one cylinder, in which two pistons, P P, drive two connecting rods, b b, the



SIMMS MOTOR SCOUT MOUNTED WITH MAXIM GUN.

latter operating the main shaft by means of two counter-shafts. Hence the motor is claimed to have all the advantages of a two-cylinder motor without its complications; there being but one exhaust valve and one admission valve. All the moving parts are also perfectly counterbalanced with respect to both weight and speed.

A small pump mechanically operated projects a quantity of kerosene into the vaporizer every second turn. The same lever which controls this pump also operates the admission valve, which is opened mechanically, as in the first De Dion tricycle.



KOCH KEROSENE PUMP.

The air rushes in and on coming in contact with the kerosene vaporizes it. In this manner a perfectly constant mixture is obtained, as the pump and the air inlet are regulated once for all by the manufacturer before the vehicle is delivered.

On the interior of the fly wheel T is the disengaging gear B. Then comes a connection between the motor shaft and the transmission shaft, the gears on which run in oil in a closed case.

The Koch kerosene vehicles are regarded as specially fitted for heavy work outside of the large cities.

The Liverpool Heavy Motor Wagon Trials.

The trials recently held in Liverpool, says the Automotor, are chiefly remarkable for the very great progress in practical and heavy automobilism that the vehicles show has been effected during the past twelve months. Last year, it will be remembered, the trials did but little more than demonstrate what was possible; they served to bring out various errors in design, and to correct not a few preconceived opinions, founded—as opinions not infrequently are—not upon what is deduced from scientific analysis but upon personal predilection, or because others think so. This year it is apparent that constructors have reconsidered their designs with the result that in every case a great improvement in performance is noticeable. Perhaps the most striking departure has been made by Messrs. Thornycroft, or, as the firm is more correctly styled, the Steam Carriage & Wagon Co. The articulated system has been abandoned, as have iron wheels, chain driving, forced draft, air condensers, etc. In short, the design is altogether distinct, and no one having witnessed the performances of these vehicles will, we think, deny that they at present not only represent the most approved British practice, but also—considering the

ratio of load to total weight—their performances far excel anything that has yet been achieved on the Continent. That the Thornycroft design in its salient features will become the more or less accepted one for motor wagons intended to carry the heaviest loads seems to us, considering the awards of the judges, very likely. At the same time it is but only fair to say that many of the best features in the Thornycroft design are to be found in the De Dion et Bouton type of heavy motor wagon. Thus the idea of transmitting the power to the periphery of the driving wheel, so scientifically applied in the Thornycroft vehicle, has long been used by De Dion in a rather crude form, and in a still cruder form it was employed by Dance in his steam carriage 68 years ago. Much diversity of opinion exists as to the relative advantages of chains v. spur wheels for transmitting the motive power to the driving wheels. In the hands of the Lancashire Steam Motor Company, chain driving has answered admirably, no doubt the result of good design and careful fitting. Much can be said for both systems. Certainly chain driving permits of a great degree of flexibility in the transmission, but such was the general excellence of the workmanship that the trials did not disclose any superiority on either side. In the position of the motors, too, we see great diversity of practice; the majority prefer the vertical marine type, placed directly on the fore part of the platform. Messrs. Thornycroft place theirs horizontally and under the platform. It seems generally agreed that wood wheels of the military type make the best form of driver for road purposes, and it is pleasant to observe that at this year's trials there were no troubles with wheels, as such. Axles in one or two instances showed a tendency to heat, due, we think, to absence of efficient means of lubrication.

Still another matter upon which constructors differ is condensers. As the result of an extended experience with them the Lancashire Company fit them, and, we believe, find them advantageous. So do Messrs. Coulthard, who use a particularly neat form of indented tubes placed in front of the vehicle. Whether, however, condensers should or should not be employed depends upon knowing the local conditions and an intelligent application of Kelvin's law of economy, which enables us to say for any given conditions whether the cost of any extra apparatus will result in any, and what, economy in working.

Nothing was more amazing to the canting fraternity and more eloquent to the general lay public as instancing the great possibilities of automobilism than the hill-climbing tests on Everton Brow. It should be remarked that the declivity in question is never used by the local carmen, and only rarely by the drivers of light vehicles, who have to, in most cases, lead their horses. As will be seen from the profile we publish elsewhere the gradient is at places as steep as 1 in 9, the average being 1 in 12. To take any vehicle up such hills, paved as they were with either boulders or granite setts, is at all times a difficult matter, but to take loads of 3 to 6½ tons up and down, to start and stop on the grade, is a wonderful achievement for these motor wagons. A traction engine, of course, could have handled much heavier loads with ease, but the traction engine can be of within reason any weight with corresponding adhesion, and it can take full advantage of broad and serrated tires. The achievement of the motor wagons consists in that they—being limited by law as to weight and compelled to use smooth tires and hence have but small adhesion—carried loads up these declivities greater than their own weight; thus a 3-ton motor wagon carried 4½ tons up this steep grade. Opinions have been expressed in many

normally rests against the battery contact point, but when the dynamo begins to generate and sends a sufficient current through the magnet coil, the magnet core attracts the armature attached to the contact spring, and the latter throws the spark coil in circuit with the dynamo. By means of a helical spring and an adjusting screw, not shown in the diagram, the amount of current required to throw the sparking circuit from battery to dynamo can be regulated; in other words, the speed of the engine at which the motor is switched in may be varied.

There is one difficulty with this arrangement which would hardly be thought of beforehand, but which soon comes to light in practice. Supposing the vehicle to be run at low or intermediate gear, and let the gear then be changed to a higher speed. The speed of the motor will then be reduced, and may be reduced sufficiently to cause the sparking circuit to be thrown back on the battery. Whether or not this change will take place depends, of course, on the tractive force required, the rapidity with which the clutch lever is being operated and the speed for which the automatic switch is adjusted. Suffice it to say, that it very frequently does occur. Now, while the transference of the sparking circuit is taking place the igniter is without current for a moment, and a number of explosions are missed. As the motor is already slowed down, a few successive mis-fires are usually sufficient to stall it. Any other cause that reduces the speed of the motor below the point for which the switch is set has the same effect as a change of the gear; for instance, an increased traction due to bad roads or hills.

With the arrangement shown in Fig. 1 a small switch has to be connected in the circuit to throw off the battery when the motor is stopped. For multiple cylinder engines this switch is preferably of the type by means of which the spark coil may be connected to all of the cylinders or to either one separately, which greatly facilitates the testing of the cylinders.

Another method of connecting the dynamo is illustrated in Fig. 2. The dynamo remains connected to the spark coil while the motor is standing. When it is desired to run the motor the battery is connected in parallel with the dynamo by means of a switch S. The dynamo is geared in such a manner that at the normal speed of the motor it generates a pressure slightly in excess of the battery pressure. While the igniter points are out of contact the dynamo sends a current through the battery in a reverse direction to that in which the battery current flows, and if the battery be of a reversible type this current will restore the active chemicals in the battery to their original state, and thus keep the battery charged. The most perfectly reversible cell is the lead accumulator, and this type is to be recommended for this work, although the ordinary Leclanche cell also keeps in perfect condition when thus connected. The advantage of the storage battery lies in the fact that for certain internal resistance it is considerably lighter and requires less space than any primary battery on the market. The positive terminal of the battery has to be connected to the positive terminal of the dynamo, and the negatives in the same way to get the current through the battery in the right direction. Where this method is employed the spark can be made exceedingly strong, even with end-on-contact-igniters, owing to the joint action of the dynamo and battery at the moment of ignition. The source of current always remains in circuit with the igniter while the motor runs, and the batteries always remain in a charged condition.

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 631,831—Clutch and Clutch-Actuated Mechanism.—George S. Strong, of New York, N. Y., assignor to John P. Murphy, of Philadelphia, Pa. Application filed Dec. 7, 1898.

Fig. 1 is a central longitudinal section through a clutch and its connections, shown specially designed and adapted for imparting motion to the driving wheels of a motor vehicle, the section being taken as on the line 1 1 of Fig. 2. Fig. 2 is a cross section taken on the line 2 2 of Fig. 1. Fig. 3 is an end view of the clutch viewed from the right of Fig. 1. Fig. 4 is a cross-section on the line 4 4 of Fig. 1. Fig. 5 is a view of the roller cage shown in central transverse section. Fig. 6 is a side elevation of the cage-actuating feather and its connecting ring, the ring being shown as on the section line 6 6 of Fig. 3. Figs. 7, 8 and 9 are transverse sections through the clutch, showing the progressive action of the cage in shifting the clutch rollers; and Fig. 10 is an enlarged fragmentary view illustrating the detailed construction of the clutch drum.

A, Figs. 1, 2 and 3, illustrates a portion of the running gear of the wagon in connection with the clutch.

Q and Q' are connecting rods, given a reciprocating movement by a motor (not shown) carried on the running gear, the said rods being moved simultaneously in the same direction by connecting both, for instance, with a crank pin and being connected at their other ends, as shown, with lever arms, Q² Q², extending the one upward and the other downward from clutch rings Q³ and Q⁴, which, as shown (see Fig. 1), are provided with inner cylindrical linings, q³ q⁴, preferably formed of hardened steel.

q³ q⁴ are counterbalances arranged on each clutch ring opposite to its arm, Q².

Q⁵ Q⁶ (see Fig. 1) are packing rings.

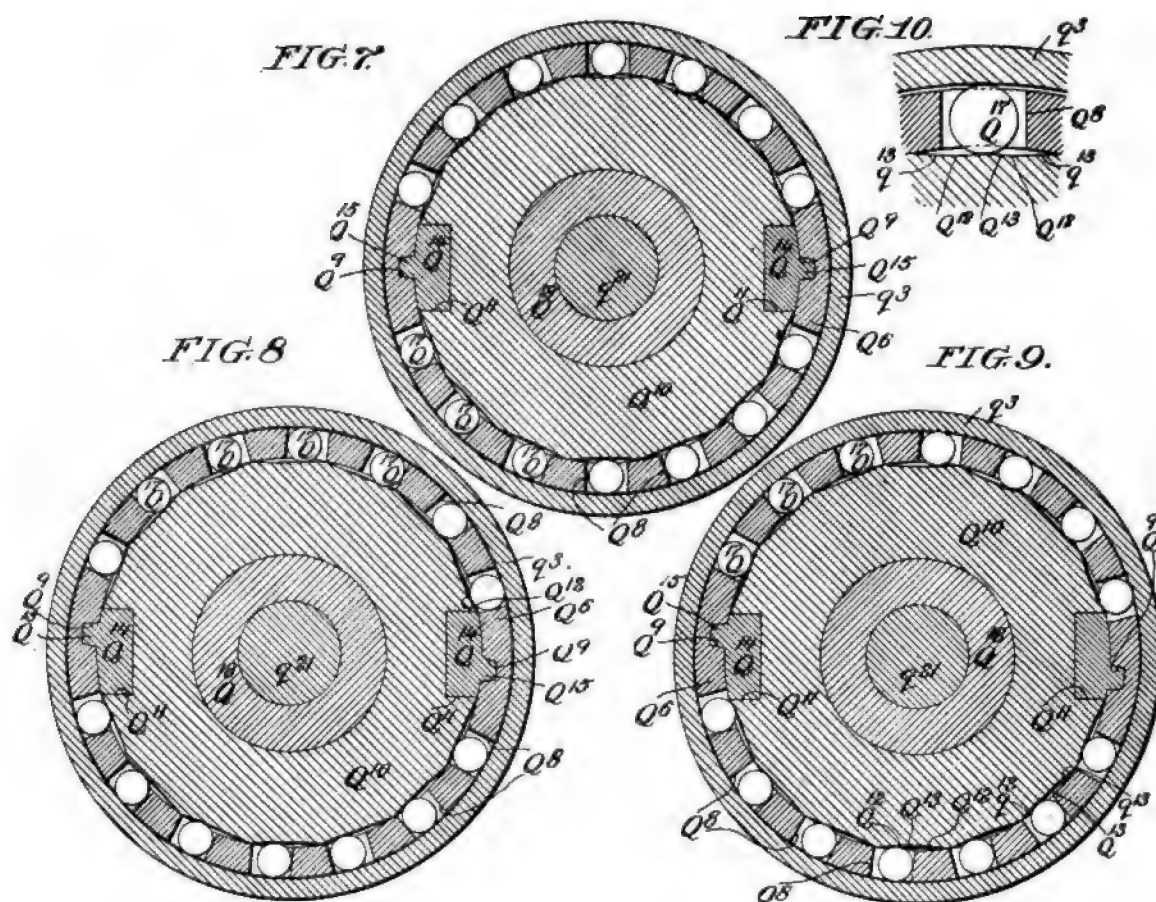
Q⁷ is a clutch-roller cage formed with a series of chambers, Q⁸, corresponding with the number of facets on the drum, the said chambers being somewhat greater in width than the diameter of the rollers used in connection with the cage and being equal in length to the length of the rollers and formed with squared ends Q⁹, to fit against the squared ends of the rollers contained in the chambers, this construction being to prevent the rollers from getting out of parallel with each other.

Q¹⁰ Q¹¹ indicate spiral grooves formed in the inner face of the cage, on opposite sides thereof.

Q¹² is the clutch drum, which is formed with surface facets, Q¹³ Q¹² Q¹², of which the surface, Q¹³, is cylindrical, concentric, or substantially so, to the center of the drum, while the surfaces Q¹² Q¹² extend outward from this cylindrical surface at very obtuse angles. In practice the breadth of the surfaces Q¹³ is 1/4 in.

Q¹⁴ Q¹⁵ indicate longitudinal slots formed on opposite sides of the drum in position to come opposite to the spiral grooves Q¹⁰ in the cage.

Q¹⁶ Q¹⁶ are keys fitting and longitudinally movable in the grooves Q¹⁴ and formed on their outer surfaces with spiral keys, Q¹⁷, fitting and moving in the spiral grooves Q¹¹ of the



cage. These keys are formed or provided with extensions, q^1 (see Fig. 6), which are secured to inwardly extending lugs, q^2 , of an annularly grooved ring, Q^{10} . In the annular groove of this ring portions S^1 of blocks S , having studs S^2 projecting outwardly from them and pivotally connected with the ends of levers S^3 S^2 , secured to a shaft, S^1 , by moving which the ring Q^{10} and the keys attached to it are moved out or in the direction and to the extent required.

Q^{17} Q^{17} , etc., are clutch rollers, one of which is placed in each chamber of the clutch ring and which are of a diameter somewhat greater, of course, than the thickness of the walls of the cage and such as will make a quite close fit between the cylindrical surfaces Q^{13} of the drum and the rings Q^8 Q^4 , or rather their interlinings q^3 q^4 . In practice the diameter of the rollers is made about $\frac{1}{8}$ in. less than the breadth of the chambers in the roller cage, and the rollers are framed with squared ends, which fit neatly against the squared ends of the cage chambers.

It is of course obvious that as the keys Q^{14} are moved in or out they will shift the position of the cage to the right or left, as the case may be, moving the rollers over the cylindrical sections Q^{13} in contact with one or the other of the oblique surfaces Q^{12} , as may be desired. In Fig. 7 the cage is represented in its central and non-operative position, in which the rollers are not in contact with either surface Q^{12} and in which a rotary movement of the ring will simply rotate the rollers without tending to rotate the drum. Owing to the construction, in which the chambers of the cage are wider than the rollers, those rollers which are on the left of a vertical section line are $\frac{1}{8}$ in. closer to the inclined surfaces Q^{12} . Extending to the left then are these rollers on the right-hand side of the line, and also of course the rollers on

the right-hand side are $\frac{1}{8}$ in. nearer to the inclined surfaces Q^{12} , extending to the right, than are those on the left-hand side of the line. Assuming now for illustration that the roller cage is shifted so as to engage the members of the clutch in a direction to drive the drum toward the right, the parts are first brought to the position shown in Fig. 8, in which the rollers lying to the right of the central vertical line first come in contact with the inclines Q^{12} , lying to the right of the surface Q^{13} , while the rollers to the left of the vertical line are still $\frac{1}{8}$ in. away. The further movement of the cage to the position shown in Fig. 9 simply brings the rollers to the left of the vertical line into operative position without moving the rollers to the right of the line, as is shown in this figure of the drawings, and by which it is clear that the surfaces of the cage lying in front of or to the right of the rollers is moved away from contact with the rollers, so that there is nothing in front of them to prevent their running forward on the inclined surfaces Q^{12} to such a degree as may be possible for them. In this position any movement of the clutch ring to the right causes the clutch members to engage and rotate the drum, while any movement to the left causes a disengagement of the clutch members, permitting the ring to move "backward," so to speak, without affecting the movement of the drum, and this occurs with an almost imperceptible shifting of position of the rollers and without appreciable noise.

Q^{18} is a shaft upon which the clutch drum Q^{10} is in the construction shown journaled, and, as shown, the shaft Q^{18} is hollow and formed to fit over the slightly conical end q^{11} of a solid shaft Q^{17} , extending to the left of the hollow shaft Q^{18} .

Q^{19} is an annular ring fitting on the shaft Q^{18} , as shown, and secured, as by bolts q^{19} , to the right-hand end of the drum Q^{10} , its outer edge extending beyond the drum and forming.

as indicated, a tight joint with the end of the ring Q^4 . On the other side of the drum Q^{10} an annular plate is secured, also by bolts q^{10} , this plate forming a tight joint with the left-hand side of the ring Q^4 and having on its outer face projections q^{10} to form bearings for the springs.

Q^{10} Q^{10} Q^{10} is an irregularly shaped casket which forms with the plate Q^{10} a box around the abutted portions of the shafts Q^{11} and Q^{12} . From its walls Q^{10} extend flanges q^{10} (see Fig. 2), which "interlock," so to speak, with the flanges q^{10} of the plate Q^{10} , and between the flanges of the box and plate are springs, Q^{10} , of rubber, by which the plate Q^{10} and the box are held together.

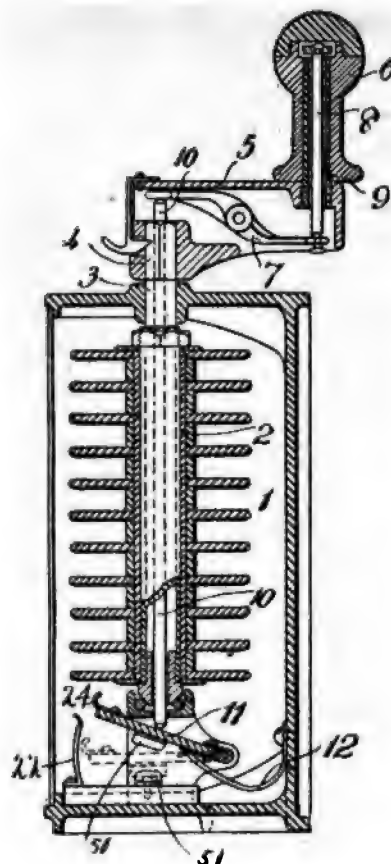
Secured to the end of the shaft Q^{11} , as by a key, q^{11} , is the hub Q^{11} of a bevel gear wheel, Q^{11} , and secured in the same or any convenient way to the abutted portion of the shaft Q^{12} is the hub Q^{12} of a bevel gear wheel, Q^{12} .

Q^{10} and Q^{10} indicate an annular spider or frame, the portion Q^{10} of which is secured, as by means of keys q^{10} , to the portion Q^{10} of the box and which is formed with openings, q^{10} , in which are placed bevel gear wheels, Q^{10} , journaled on pins, Q^{10} , extending across the openings q^{10} and secured on the outside and inside thereof, as indicated at q^{10} and q^{10} . The bevel wheels Q^{10} have their teeth engaged on opposite sides with the bevel gear wheels Q^{11} and Q^{12} . The arrangement of the gear wheels coupling the shafts Q^{11} and Q^{12} together is in its general features a familiar compensating device, by means of which in case of the turning of the vehicles the driving wheel on the outside is permitted to move, as it must, on a longer path than the driving wheel on the inside, without disturbing the application of power to either of them. The function of the springs Q^{10} is of course to act as an equalizing device between the clutches and the shafts upon which the clutches operate—that is, these springs equalize the application of the power to the compensating device through which the power ultimately reaches the driving axles, a feature of construction which the inventor believes to be entirely new, as also the construction of the plate Q^{10} and the irregularly shaped box casting by which the equalizing and compensating devices are inclosed and protected from the dirt.

On the box is formed on its section, Q^{10} , a brake drum surface, upon which fits the brake band (indicated at M^{10}), said band being secured at one end to fixed arms, m^{10} , and at the other end to a lever, M^{10} , by means of which the brake band can be tightened at will. This feature of construction is of value, because by its means is applied the braking pressure equally to both driving wheels at all times, the resistance of the brake acting through the compensating device just as does the power of clutches.

No. 631,917—Signaling and Controlling Apparatus for Motor Vehicles.—William Richard Wynne, of London, England. Application filed March 30, 1899.

Claim.—In a controller for electric motors the combination with the controller drum of a removable crank, a handle for rotating same which is also capable of a vertical movement, a rod sliding within the axle of the drum, means connecting the said rod and handle whereby a vertical movement of the handle causes a similar movement of the rod, an electric switch in the path of said rod, said means consisting of a lever, 7, located in the said crank 5, which is hollow, and pivoted thereto, one end of the lever having a pivoted connection with said handle through the agency of a rod, 8, connected to said handle, and the other end of said lever resting upon first said rod 10, and a spring, 12, normally pressing the



rod 10, upward and thereby maintaining the said handle 6 in its lowest position.

BRITISH PATENTS.

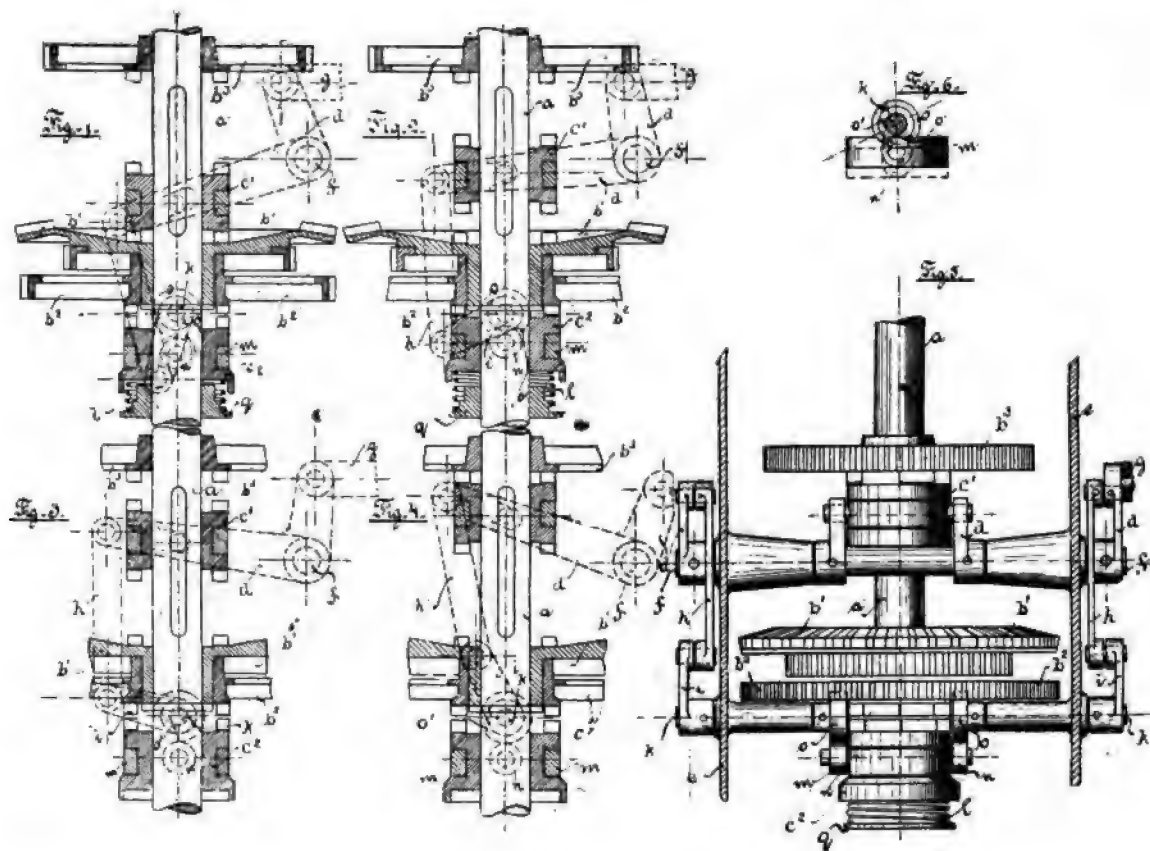
No. 8469—An Improved Device for Regulating or Controlling the Movement of Motor Cars.—The Victoria Fahrrad-Werke, Nuremberg, Germany.

Figs. 1-4 are sectional views of a form of construction of the improved regulating mechanism for operating motor cars in four successive positions, whilst Fig. 5 is an elevation. Fig. 6 is a detail.

Three toothed wheels b^1 b^2 b^3 are mounted to run loosely on the rear axle of the motor car, which wheels are driven from the driving axle either directly or by means of intermediate gearing, the wheel b^1 traveling rapidly forward, the wheel b^2 traveling slowly forward and the wheel b^3 slowly backward. On the same axle a , two clutches c^1 c^2 are mounted by means of a tongue and groove, so as to be adjustable longitudinally, which clutches as may be seen in Figs. 1-4, according to their position, transmit one of the three movements previously mentioned to the three toothed wheels on the axle a . Such a gearing is already known, forming the subject of a prior patent.

In order to render it unnecessary to employ two separate levers for operating the clutches c^1 c^2 , the following arrangement is adopted:

The clutch c^1 is operated by both levers d pivoted on a shaft f mounted in the frame e . Fig. 5, and may be adjusted by means of a hand lever g . The ends of the levers d are connected by means of links h with the ends of two levers i pivoted on shafts k mounted in the frame e . In the position shown in Fig. 1 the clutch c^1 is pressed forward by a spiral spring l , held in place by a cap q , but cannot engage with the



VICTORIA FAHRRADWERKE.

clutch teeth of the toothed wheel b^2 , as rollers n mounted on a collar m of the clutch bear against cam disks o firmly connected with the levers i . The clutch c^1 is, however, maintained by the lever d in engagement with the wheel b^1 which is rotating rapidly forward so that the movement of this latter is transmitted to the wheel axle a , and thus the whole motor vehicle travels at a rapid speed forward.

If then the hand lever g be moved to the right, the apparatus comes into the position shown in Fig. 2. The two rollers n in this case drop into recesses or notches o^1 in the disks o so that the clutch c^1 in consequence of the pressure of the spring i engages with the wheel b^2 , which is traveling slowly forward, and thus the wheel axle is also rotated slowly forward and the vehicle travels slowly forward. The clutch c^1 is also simultaneously released by the lever d from the toothed wheel b^1 .

On the lever g being further moved the regulating device comes into the position shown in Fig. 3.

The rollers n have here emerged from the notches o^1 of the disks o so that the clutch c^1 no longer engages with the toothed wheel b^2 .

The clutch c^1 is also in this position of the lever d , held out of engagement with the toothed wheels, and the axle thus does not share in the rotation of the toothed wheels, i. e., the vehicle becomes stationary.

Finally, in Fig. 4, the lever g is in its extreme end position. In this case the clutch c^1 is also as in the last case held out of engagement with the toothed wheel b^2 by means of the disk o , but the clutch c^1 is engaged by means of the lever d with the wheel b^1 which is rotating slowly backward, so that the axle also rotates slowly backward.

By a single manipulation of the lever g any desired kind of travel may be obtained. A suitable pointer or indicating mechanism may be connected with the lever in such a way as to indicate on a suitably divided scale the actual direction of travel of the vehicle in the various positions of the lever.

No. 9969—Improvements in Brakes for Vehicles, Motor Cars, etc.—Ernst Lehut, Paris, France. Application Filed May 11, 1899.

Fig. 1 is a longitudinal section and Fig. 2 a transverse section.

1 is the axle tree on which the wheel 2 turns; 3 is a bracket made in one with the axle tree or fixedly secured to it in any suitable manner. The bracket is provided with two arms 4 and 5 for receiving the loops 6 and 7 of the collars 8 and 9; 10 is a metal drum fastened on the nave of the wheel 2, and surrounded outside by the collar 8 and inside by the collar 9. The collar 8 is made of a large band 8^1 and a smaller one 8^2 , the first covering the second one. They are of metal and covered with leather bands a on the side toward the drum or hoop 10. The bands 8^1 and 8^2 are joined together by a hook 8^3 arranged on the extremity of the band 8^2 and engaging into an opening arranged on the corresponding extremity of the band 8^1 .

The free extremity of the band 8^2 is joined by a fork 11 with the arm 13 of a bent axle 12 on whose opposite end a lever 14 is keyed at right angles, joined by a chain or link 21 with the cross piece 15.

The collar 9 is formed by a large band 9^1 and a smaller one 9^2 , the first covering the second. They are of metal covered with leather bands b on the side of the hoop 10. The bands 9^1 and 9^2 are joined together by a fork 16, arranged on the

extremity of the band 9' wherein the extremity of the band 9' penetrates.

The free extremity of the band 9' is joined to a thong 17 whose other extremity is fixed on the periphery of a pulley 18 fastened on the end of a shaft 19 on the other end of which another pulley 20 is arranged on the periphery of which the end of a chain 22 is fastened which is wound up in the contrary direction of the thong 17, and whose other end is fastened

stopper B is also traversed centrally from end to end by a rod C, the "T" shaped head C' of which extends beyond the stopper. A nut J screwed on the rod C prevents all lateral displacement of the rod. The rod has a prismatic part on which is placed a disk E. The handle A is fastened to this disk by the screws V V, and it is also retained on the rod C by a sunken nut K screwed on the screw threaded extremity of the rod.

Fig. 2

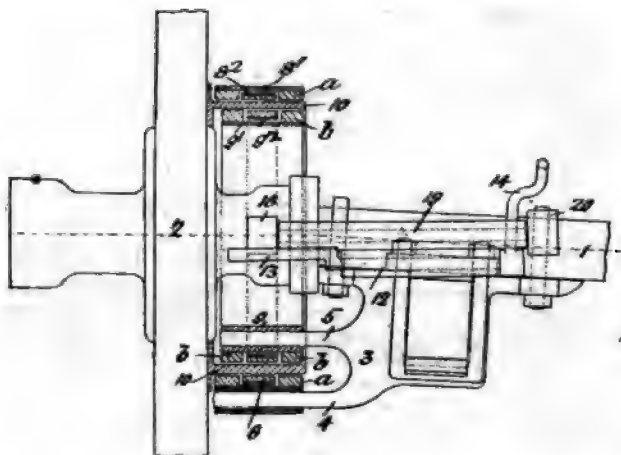
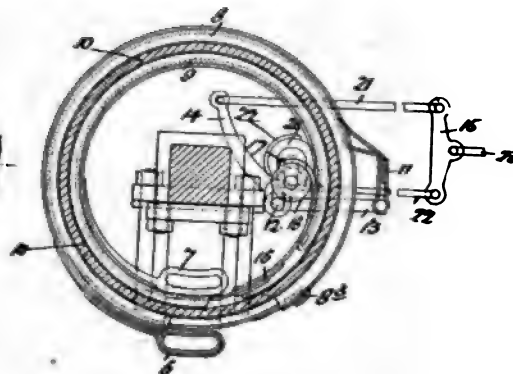


Fig. 1



LÉHUT BRAKE.

on the cross piece 15. The leather bands are for the purpose of augmenting the adherence of the collars on the hoop; 23 is a chain which is connected with a pedal arranged near the driver of the vehicle.

The following is the manner of working: When the driver wishes to work the brake he actuates the pedal which by means of the chain 23 moves the cross piece 15 and the chains 21 and 22 follow it. The chain 21 moves the lever 14 and by means of the shaft 12 draws the arm 13 with it, and consequently the fork 11 draws upon the band 8' of the collar 8 which tightly embraces the hoop 10 and draws the band 8' with it, which also embraces the hook 10, whose rotation and consequently that of the wheel is stopped. At the same time the chain 22, influenced by the cross piece 15, moves the pulley 20 and also the pulley 18 by the shaft 19, which, drawn by the thong 17 on the extremity of the band 9' of collar 9, draws this band and band 9' against the hook 10, which it prevents from turning in the contrary direction that is backward. The wheel can consequently neither turn forward nor backward.

It is clear that this construction can be modified; instead of using one pedal, two could be used, actuating the collars separately. In this case the cross piece 15 is suppressed.

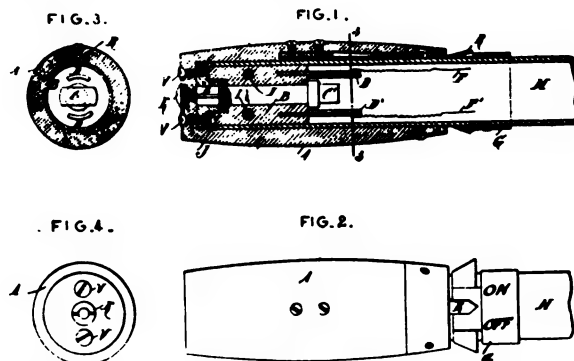
No. 9773—Improvements in Means for Interrupting the Ignition Current of the Motors of Motor Cycles or the Like.—Application filed May 9, 1899.

Fig. 1 is a longitudinal section of the improved handle. Fig. 2 a plan view thereof. Fig. 3 a cross section on line 3—3 of Fig. 1, and Fig. 4 is an end view.

The handle A, which may be of ebonite, is adapted to turn with slight friction on the end of the handle bar or steering bar H. A stopper B, also of ebonite, closes the extremity of the tube H and is fixed to it by means of screws or pins I. The stopper B carries two elastic plates D D' diametrically opposite one another and having soldered to them respectively the two wires F F' of the electric circuit. The button or

The handle A can thus be turned on the tube H without displacement in the direction of its axis. Near the inner end of the handle there is fixed on the tube H a sleeve G hollowed out with a recess of convenient width between which an index R is movable. This index consists of a metallic spring fixed in the handle by means of screws, as shown in Fig. 1, so that it moves with the handle and may point to the one or other of two indications engraved on the sleeve near the edges of the recess, for example "on" or "off."

In the position of the parts as illustrated in Figs. 1 and 2 the springs D D' have no electric communication between them, and the circuit is open. The current cannot therefore pass to the igniter and the motor is not operated. The index R would point to the word "off."



To produce the spark which determines the explosion of the gas mixture in the motor and put the latter in action, the handle A is turned so that the index R points to the word "on." By this rotation the disk E and the rod C turn with the handle, and the head C' being somewhat wider than the space between the springs D D', comes in contact with the latter,

which by virtue of their elasticity press against the head and are thus put in electric communication. The circuit of the induction bobbin is thus closed and the spark can then pass between the points of the igniter.

To stop the motor, it is sufficient to turn the handle so that the index R points to "off." The head C' is disengaged from the springs D D', the circuit is opened, and the motor stops.

No. 9,188—Improvements in Motor Vehicles.—Julius William Walters, New York, N. Y.—Application filed May 2, 1899.

This wheel for motor vehicles was described in the May 10 issue of The Horseless Age.

No. 6,136—Positioning Apparatus for Motor Vehicles.—George Herbert Condict, New York, N. Y. Application filed March 21, 1899.

This invention relates to apparatus whereby an electric vehicle is directed into proper position with respect to mechanical loading and unloading apparatus, so that a tray of exhausted batteries may be removed therefrom and replaced by a tray which has been charged and is ready for use.

No. 13,345—Improvements in or Relating to Driving Gear for Motor Cycles and the Like.—Ateliers de Constructions Mecaniques, Mulhausen, Alsace, Germany. Application filed June 27, 1899.

This invention has for its object an automatic coupling for such cycles as are to be converted into motor cycles, the coupling being capable of being arranged on any existing bicycle without reconstructing the frame or hub of the back wheel.

No. 1,116—Improvements in or Relating to Motor Road Vehicles and Devices for Controlling the Various Operations Relating to Starting, Stopping, Accelerating and Retarding the Same.—Elmer A. Sperry, Cleveland, O. Application filed Jan. 17, 1899.

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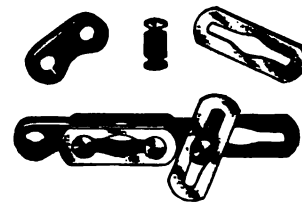
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VOLUME 4

SEPTEMBER 13, 1899

NUMBER 24

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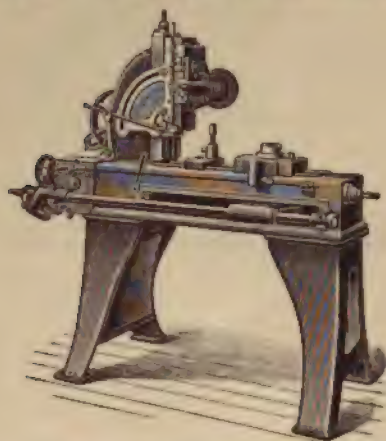
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VOL. IV.

NEW YORK, SEPTEMBER 13, 1899.

No. 24.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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Liquid Moonshine.

Promoters of liquid air companies are taking advantage of the popularity of the automobile to introduce the term into their corporate names and lay special stress upon the availability of liquid air for the propulsion of vehicles. In the circular of a company recently formed in New England to manufacture liquid air and apply it to various commercial purposes, a large amount of space is devoted to the liquid air automobile; the defects of all other systems of vehicle propulsion are minutely described, while the freedom of liquid air from these defects is triumphantly asserted. Of course, the little difficulties in the way of the economical production of liquid air are entirely omitted in this glowing prospectus. This part of the problem is dismissed with the vague statement that the company has a new and ingenious process of manufacturing liquid air which reduces the cost to almost nothing. If the promoters of this company would only give

us some actual figures representing this cost, we would have a tangible basis on which to estimate the value of their system. We know that it takes power to compress air or any other gas, and that the liquefaction of gases can only be obtained by the use of more power than is required for compression. Very interesting laboratory experiments have been made with liquid air, and it is quite certain that ultimately commercial uses will be found for it; but the possibility of its competing to any extent with the prime movers in the propulsion of vehicles is as vague and remote as the claims of its promoters. Until it can be demonstrated that liquid air can be economically produced, such literature as this prospectus must be regarded as liquid moonshine.

Friction Transmissions.

Much time and money have been spent by inventors of both hemispheres in the effort to devise a practical variable speed friction transmission for motor vehicles. Friction disks of various kinds have been tried with faces composed of compressed paper, wood, leather and other materials tending to increase the friction, but no machine of this kind has long remained in practical use. The size of the frictional surfaces required to transmit power sufficient to drive a carriage is so great that they become inadmissible on account of the room they take up on a carriage. Le Pape, the French inventor whose carriage was described in one of the early issues of The Horseless Age, about exhausted the subject of friction disks and was compelled to abandon them entirely for the reason above stated. He found it necessary to increase the dimensions of his surfaces time and again, until he was compelled to admit the case was hopeless.

Another frequent objection to the friction disk (and other friction devices as well) for this class of work is want of positiveness. Motor vehicle transmission is the most brutal and exacting kind. In the starting, stopping and continual

and rapid changes of speed, a transmission device is required that will grip firmly and hold with certainty. No toys or make-shifts will answer. As an eminent English engineer once remarked to the editor of *The Horseless Age*, on looking at one of these friction transmissions: "This man evidently never had any experience in traction. Traction means business."

Steam Overland Freighting.

We wish to call particular attention to the article in this issue describing a steam wagon train, or system of overland freighting, which is destined to play an important part in the development of motor road locomotion in many lands. It is evident that a machine of this kind is not universally applicable. In some districts the nature of the roads would bar its use, but wherever the soil is reasonably compact and water is easily obtained, it can be operated, the manufacturers state, at about one-half the cost of animal power. In agriculture, mining, quarrying and for the transportation of general merchandise in regions remote from railroads, outfits like this would seem to be indispensable at the dawn of the twentieth century.

Steam wagon trains may also be supplemented with advantage by gasoline or kerosene vehicles for lighter work. Several large transportation companies in southern countries are now placing orders here for both types of vehicle, on the satisfactory performance of which depends the wholesale replacement of animal power by motive power in several of the semi-tropical commercial centers.

Too Light.

In spite of precedent and in spite of repeated warning, many of our inventors and manufacturers are producing vehicles altogether too light for the service required of them. The public, they contend, demands light carriages, and we must give the public what it wants. But it is not always wise to humor the public, for the public is fickle and inclined to change its mind suddenly when it discovers that it is wrong. Hence it is manifestly the true policy, when the public is not sufficiently informed, as in motor matters, to look further ahead and build machines which will give permanent satisfaction, knowing that the public will see its error eventually and choose the solid and substantial thing. The stresses and shocks that motor vehicles are subjected to can be ascertained by capable engineering, and the strength of the materials required to withstand them can be computed theoretically and tested practically, so that there need be no guesswork in any of the details. A little ephemeral popularity is dear-bought if it is followed by failure and loss of reputation.

The Automobile Parade.

The automobile parade at Newport last Friday was noteworthy on several accounts. It was the first formal public recognition of the automobile by our American aristocracy, and was a charming spectacle as well, the vehicles being handsomely decorated with flowers and ornamental designs. Electricity, gasoline and steam were represented in the procession, and while the day did not pass without accidents, one of which was of a distressing nature, the function was regarded as a unique success by the participants and by the residents of America's most fashionable water place.

Now that the Four Hundred have set the seal of their approval upon the automobile, builders of motor pleasure carriages may look for generous patronage from that source, which will be most opportune at this early stage of the industry.



HEYMANN GASOLINE CARRIAGE.

The Heymann Gasoline Carriage.

The Heymann gasoline carriage, first described in the November, 1898, issue of *The Horseless Age*, has been tested on the road for over a month, and is said to give satisfactory service. The makers, the Heymann Motor Vehicle & Mfg. Co., Melrose, Mass., promises full details soon.

Investigating Gasoline Now.

It is reported that B. Altman & Co., of New York, the pioneer house in the adoption of electric delivery wagons, are investigating gasoline motors.

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Racial Traits in Motor Vehicle Design.

By A. H.

Just as the art expert in glancing at pictures in a picture gallery can well divine their origin, so can the trained eye of the engineer usually tell the birthplace of a motor carriage he sees on the road. In fact, not only can one tell the nationality of the design, but frequently also that of the manufacturer, since a French carriage built in France looks very different from one of French design built in England.

Comparing the representative types of motor carriages of the different nations, we shall consider the motive power used, the method of driving and steering, and the general build of the vehicle.

As regards motive power, we might say that it is principally electricity in this country, oil in France, England and Germany.

The reasons for this difference are not far to seek. In this country the electrical industry has made such progress as to enable electric pleasure carriages to be run quite satisfactorily. Moreover, the majority of motor carriages running in American cities are two or four seated vehicles for the conveyance of passengers, and rarely travel outside the city limits over hills and bad roads, and the distance to be covered is seldom greater than one charge of batteries will allow.

In France conditions are different. If you can build a carriage with plenty of taps, floats, levers, hand wheels and adjustment screws on the outside you are sure to meet the French taste, and if you operate it with oil there will be a chance that the carriage will get stuck on the road and give the "chauffeur" an opportunity to prove to his own satisfaction and that of his friends that he is a genius and able to make things revolve after tickling the mechanism for some little while.

It seems that while motor carriages to be popular in this country and England must be comfortable vehicles, manageable and reliable, they are preferably so constructed in France that it is an art to sit on them when they are moving, and that nobody but their proprietor thinks he knows what all the mechanism is for.

The German oil carriage is in most cases far simpler than that of French design, though the Daimler motor, a German invention, is being largely used in both French and German vehicles.

Electric motors, where possible, are most desirable, as they are rotary and most readily applied to revolve the wheels. But in England and Germany, leaving out of consideration the rest of Europe, the motor carriage has to serve a different purpose. It is much used to run in districts where there is no steam road or electric line, and has to make long journeys with one charge of fuel, or, rather, be able to replenish the exhausted source of power en route.

Electricity, of course, is not adapted for this purpose. No battery will stand the jar and jolting of rough country roads without being disintegrated soon, and as regards the weight, we know that 1 lb. of weight does not represent more energy than 7 to 10 watt-hours in the best type, and that where we wish to run some distance the dead weight to be carried will make electricity prohibitive. Oil, coal or coke will burn up and lighten the car, but electric batteries remain just as heavy whether they be charged and representing the source of motive power or whether they are exhausted and nothing else but ballast. So it comes that oil is largely in use abroad. Of course, the average Englishman is not yet fond of this means

of locomotion, and the most perfect oil carriages built in England are making their way rather slowly into popularity.

It seems to be the standard practice abroad to attach the engine in front of the vehicle and drive backward by means of gear wheels, shaft and double chain. Some French carriages still use belts, but in England, with her quick climatic changes, belts do not seem to prove attractive for the purpose.

The driving is in a few carriages effected in front, after the style of some of the electric cabs running in New York. The idea is that such a carriage will steer straighter and ride with the driving wheels first over an obstacle, where otherwise the steering wheels might be thrown sideways and the vehicle made to skid.

Much ingenuity is shown in French steering gears; generally, however, the Ackermann gear, or articulated axle, is considered the best, and is most in use.

Gearing and chains being prominent parts of European vehicles, these have been designed with great care, and one has to admit that they give much satisfaction as they are arranged at present. As a rule they are encased (dust proof) and show little sign of wear after hard use.

In the general build of vehicles it is noticeable that the English carriage is much heavier in proportions than the French. One might say it is the old excuse of the English designer to pride himself on the substantial character of his work instead of acknowledging that he did not know how much lighter he could build without coming to grief. But it must be admitted that it is a mistake to make a motor carriage frame light when it has to be durable. The twisting and racking when on the road is very great, and however elastic the connection may be between wheels and motor, the latter should be on a rigid foundation, which means attached to a heavy frame.

It is just the difficulty in making a compromise between these two opposing desiderata, elastic vehicle and rigid engine base, which accounts for most failures in motor vehicle design.

One great point in favor of English carriages I have seen is that their center of gravity is usually lower than in the French carriages. This I consider very desirable, as it facilitates rapid braking without the danger of upsetting. Topheavy vehicles are besides dangerous in taking curves, though it seems that the popular London 'bus, a most unmechanical looking affair, does quite well in balancing its outside passengers.

As regards the finish and outlines of the carriages, it must be admitted that those of French design are more graceful than the English types. One has only to look at the London electric cab, or look back at it rather, as they have not been running for some weeks, to become permanently discouraged at the prospects of motor traffic.

On the other hand, there were some outrageous designs recently to be seen in Paris; for instance, motor mail coaches of the baroque style, and some of the carriages were so arranged that you could see a dynamo, numbers of flasks, brushes and household articles about, which plainly indicated that it did not matter if this vehicle got stuck on the road, since the tourists would have lots of fun with the things they took along.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.



ON THE ROAD.

Steam Overland Freighting.

The overland freighting train, with its powerful engine and long train of heavily loaded wagons winding along the country road, or in and about the plantation, or reaching across the wide stretches of the Western ranch, is a fitting picture for the close of the nineteenth century. The horse, the mule, the ox and even man himself have all been called upon to solve the problem of transporting freight overland. Enterprises have lagged, many opportunities have lain dormant because this problem could not be successfully met. The steam overland freighting train is a practical, scientific solution. The application of steam power to traction engines designed for the work to be done, with wagons adapted to the kind of freight to be hauled, affords a method of transportation that has large capacity, is economical to operate and that can be successfully operated, as a rule, wherever the four-footed beasts of burden have been used. Each outfit or train requires an engineer and two helpers and will do the work of many teams and many men.

These outfits are particularly adapted to haul freight of any description from out-of-the-way places. In the mining regions many mines are situated from 10 to 40 miles from a railway, and the cost of transportation of low grade ores by mule teams or oxen becomes prohibitory, and many mines are not worked on account of this one difficulty. These trains, when designed to meet each individual case presented, reduce the cost of transportation per ton at least one-half, and in many instances two-thirds.

The wagons are built specially to suit the needs of each particular class of freight to be handled. For silver and copper ores, sulphur, borax, limestone, they generally have a capacity of not less than 320 cu. ft. The diameter of the wheels and the faces are varied to suit each particular soil over which the freight must be hauled, while the character of the wagon is varied to facilitate loading and unloading. Most natural dry soils give but little trouble to these trains, while soils that consist mainly of loose, deep sand are the most troublesome. The aim, however, in each particular case is to design the wagons to meet the conditions and to carry the greatest paying load

with the least expenditure of power. The length between water stations is a most important factor in the system of transportation, for unless water is available every six miles or so, the amount of paying freight hauled must be reduced in the same proportion as the weight of the necessary water carried is increased. If the water stations are further apart, say 6 to 15 miles, a tender is furnished for additional water and coal.

Grades not exceeding 5 per cent. are easily taken, but on roads that have many long grades exceeding this a reduction of paying freight must be made. For copper mines the wagons can be built to carry sulphuric acid safely in bulk of 10 tons per wagon. The necessary lead lining, however, makes the wagons very heavy.

For sugar plantations, where the cane has to be hauled to the mill, these trains are well adapted, for as the distances from the mill are usually short, one engine can take out a large number of empty wagons and distribute them in various parts of the plantation, and instead of waiting for them to be loaded the engine can go on and pick up wagons that have been dropped at a previous trip and loaded in the meantime. It will be seen that the engine can be continually supplying loaded wagons to the mill and supplying the fields with empty ones. One engine alone in one day has hauled as much cane to the mill as can be hauled by 60 ox teams requiring sixty men and 360 oxen, the engine requiring only three men (engineer and two helpers) to deliver an equal amount. This system of hauling, however, requires a very large number of strong wagons. A train of 12 wagons, each loaded with $5\frac{1}{2}$ tons of cane, making a total weight of 108 tons behind the engine, has been hauled successfully from plantation to mill at one trip.

Coal or wood can be used equally well to operate these engines without alteration in the fire box.

The cost of operation is estimated as follows :

		s.	£ s.
Engineer	\$2.50 to \$ 4.00	10	to 0 16
Fireman	1.50 to 2.50	6	to 0 10
Helper	1.00 to 1.50	4	to 0 6
Two tons of coal at \$2 to \$6 each..	4.00 to 12.00	16	to 2 8
Lubricating oil	50 to 1.00	2	to 0 4
Depreciation per day	2.00 to 4.00	8	to 0 16
Total	\$11.50 to \$25.00	46	to 5 00



RIGHT SIDE FRONT VIEW.

A fair estimate of the operation of the engine is that it will carry 30 tons 30 miles for from \$15 to \$20 per day, with reasonable grades.

An excellent example of this most useful type of motor vehicle was recently built by the O. S. Kelly Co., of Springfield, O., for use on a large Cuban sugar plantation. It differs materially from other traction engines. The enlarged diameter of the drive wheels is apparent to the casual observer, while the construction of steel plates and angle rings securely riveted appeals forcibly to the practical man. These drive wheels are built up around a center casting to which are securely riveted the two circular side sheets; their peripheries, being fitted with heavy angle rings, form connecting flanges for the steel plate tire. This tire is fitted with diagonal plates or cleats 4 in.

wide and 2 in. thick, extending completely across the face at such angles and distances apart as to insure the complete bedding of one plate before the preceding one has left the ground. To insure lateral stiffness, pieces of each side plate are cut out at regular intervals to form the spokes, and the edges of these spokes are fitted with steel angles, enabling the two spokes to be tied together by the cross plates, the spokes thus forming a hollow box pattern. The whole wheel is fairly light, very strong and practically unbreakable. It will be noticed that holes are provided for three locking pins. One pin is sufficiently strong to take the whole of the driving strain, but in practice three are used to prevent undue wearing of the pin holes. The method of driving with one pin only is universal.



LEFT SIDE REAR VIEW.



STARTING FROM MILL WITH EMPTY WAGONS ON SUGAR PLANTATION NEAR MANZANILLO, CUBA.

The hub is bored smooth for a length of 20 in., fitting the 8-in. axle. It is seen that there is nothing to wear out but the diagonal plates, which are easily renewed. These plates or cleats are tapered on the ends for a distance of 3 in. from 2 in. to 1 in. thick so that on hard soil the bearing surface is reduced from 24 to 18 in., which enables the engine to travel over hard roads that are covered with 2 in. to 3 in. of loose sand, with a considerable reduction of friction. The diameter is 8 ft. and the weight of each wheel 6,000 lbs.

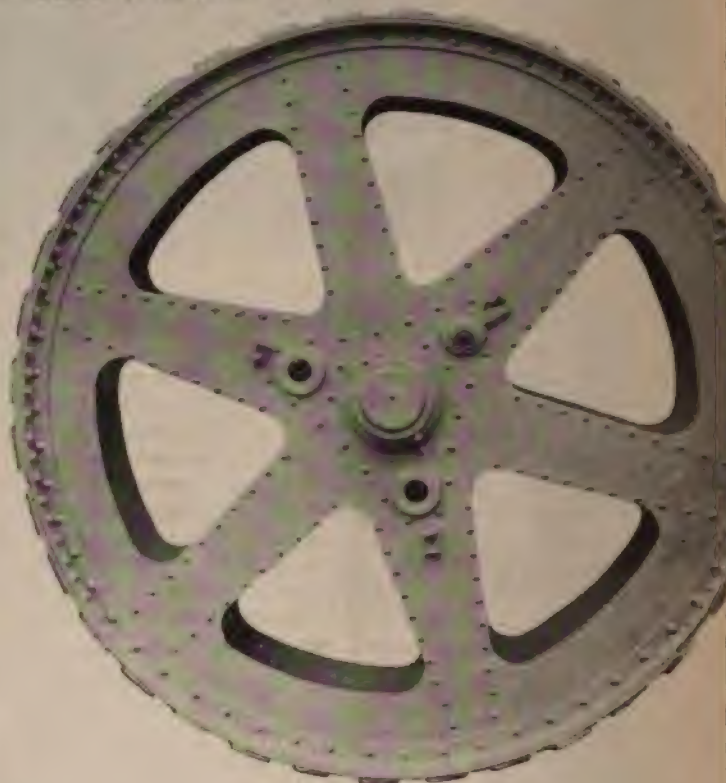
The front wheels are 5 ft. in diameter with 12-in. face, built up and cut out in precisely the same manner, with the exception that the spokes are tied together with a single plate extending down the center, making an I-beam section instead of box section. The tires of each wheel are fitted with a



FIELD VIEW ON SUGAR PLANTATION NEAR MANZANILLO, CUBA.

single band 4 in. wide and 2 in. thick, to reduce friction and make steering easy; which is accomplished in the usual way by hand wheel, worm and shaft, fitted with chains attached to the front axle.

The engine mounted on top of the boiler has no fly wheel, and the triple-throw crankshaft with cranks 120 degrees apart fitted with three pairs of eccentrics, all made entirely from a single forging, is balanced perfectly in all positions, and as the point of cut-off is carried late enough to always insure the admission of steam to two pistons, the starting of a heavy load is easily accomplished. Another point is noticeable, in that the crankshaft runs in four bearings, all fixed in such a manner as to be entirely unaffected by the expansion and contraction of the boiler.

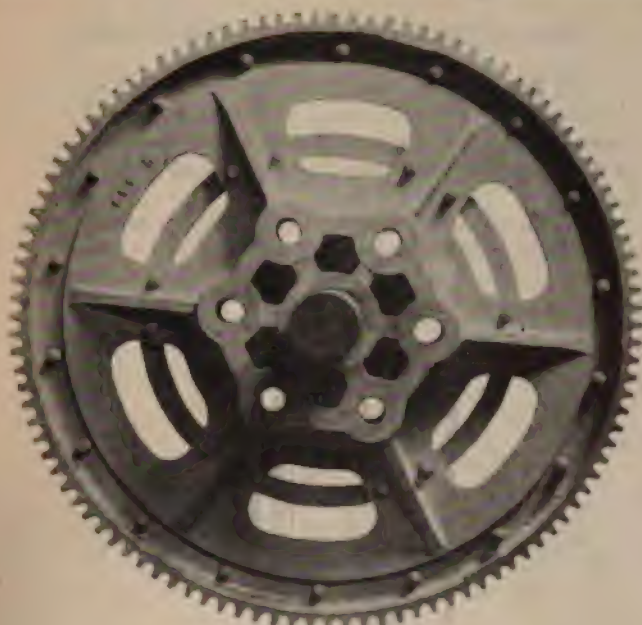


DRIVE WHEEL.

The reverse gear is of the Marshall pattern, the eccentric rods standing perpendicular to the center line of the engine, while the valve rods attach to a point two-thirds of their length from the crankshaft center. The reverse lever swings about a center situated above the crankshaft in a vertical plane, instead of the usual movement in the horizontal plane by lever when link motion is used. This reverse can be clamped in any position from full stroke forward or backward to the center.

One pinion only is fitted to the crankshaft which gears direct into a large spur wheel attached to the driving axle. All counter shafts and intermediate gears are conspicuous by their absence, and the engine resolves itself into a three-cylinder geared locomotive, fitted with very large wheels, specially adapted for travel over natural soil in countries where dry seasons are the rule.

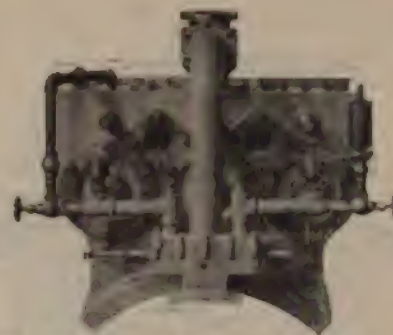
The three cylinders, together with their valve chests, form one large casting placed on the forward end of the boiler. The valves being placed on top, access to them is easy at all



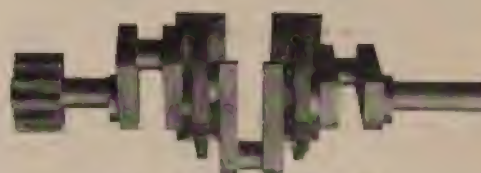
SPUR WHEEL.



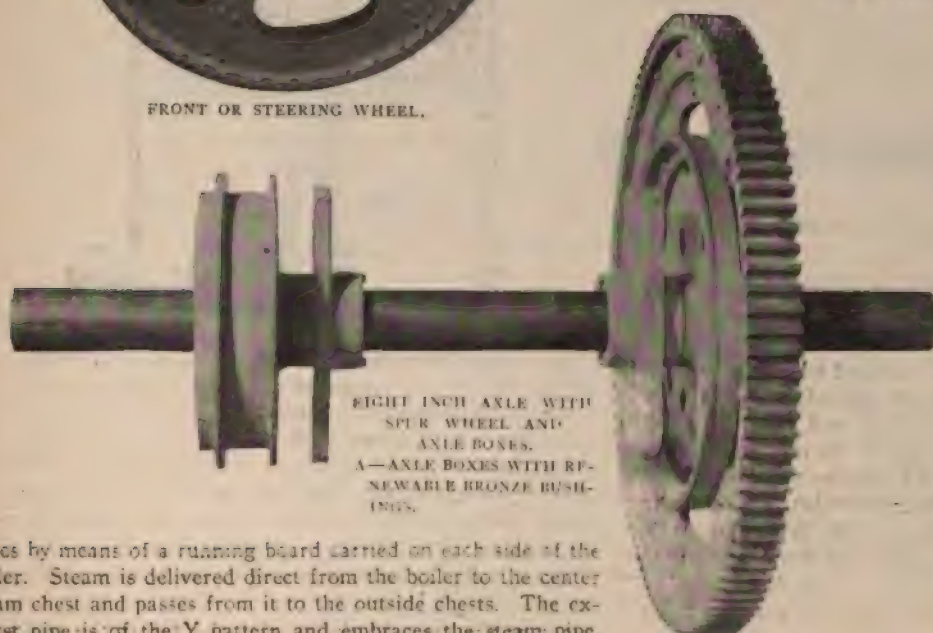
FRONT OR STEERING WHEEL.



FRONT VIEW OF CYLINDERS WITH STEAM PIPE.



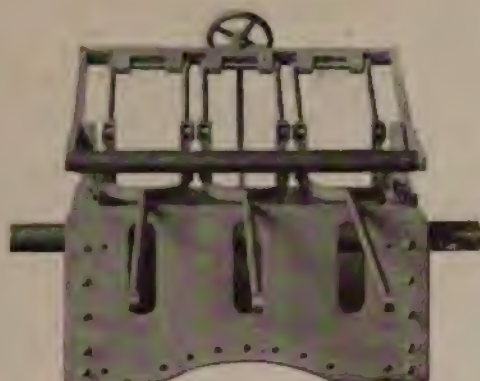
TRIPLE THROW CRANKSHAFT.



EIGHT INCH AXLE WITH
SPUR WHEEL AND
AXLE BOXES.
A—AXLE BOXES WITH RE-
NEWABLE BRONZE BUSH-
INGS.



times by means of a running board carried on each side of the boiler. Steam is delivered direct from the boiler to the center steam chest and passes from it to the outside chests. The exhaust pipe is of the Y pattern and embraces the steam pipe,



REVERSING GEAR.

which is placed exactly on the center line of the boiler, and is fitted with a swash plate to prevent water carrying over to the cylinders.

The pistons, slide bars, cross heads and connecting rods are of the simplest design, with unusually large wearing surfaces.

The boilers are of the locomotive type with grate surfaces



SLIDE VALVES AND CROSS HEAD.

varying from 9 to 12 sq. ft. The diameter is 43 in., thickness of plate 7-16 in. throughout, double riveted in every seam, lagged with 1 3/4-in. covering and finished with Russia iron. The boiler pressure is 180 lbs. per square inch.

The tank has a carrying capacity of 1 ton of coal and 600 gallons of water.



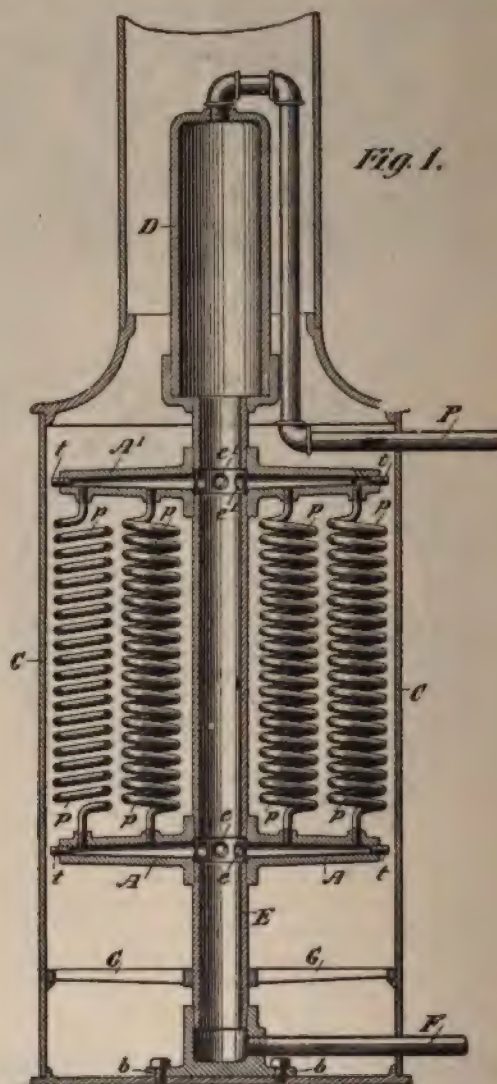
FRONT AXLE WITH SWIVEL BLOCK.

These engines will give a continuous tractive force of 12,000 lbs. at the wheel rim, moving at the rate of 330 ft. per minute, and for short intervals this force can be doubled. The speed, however, will drop. The power developed will be $330 \times 12,000 = 3,960,000 \div 33,000 = 120$ h.p. In general, it may be stated that with suitable wagons for the soil and roads free from grades exceeding 5 per cent., a load of 30 tons, exclusive of engines and wagons, can be hauled 30 miles per day. But no two conditions are alike, and the distance between water and coal supply stations make important changes in the amount that can be hauled. If the road be entirely free from loose sand, a considerably greater load can be hauled. Over dry, natural soil these engines have hauled a total weight of 112 tons behind them.

Non-Explosive Steam Generator.

David Rousseau, of New York, has invented a new type of steam generator that seems to be suited for carriages and trucks. This type of generator has only been made possible by the recent progress in fine steel castings, of which the heads are made.

The coils are made of either steel or copper tubing, put together with right and left threads at each end. They are so flexible that they can be easily compressed and inserted.



Any steam fitter can put the parts together or repair them as the coils are uniform and are perfectly accessible.

The construction is as follows: Fig. 1 is a vertical longitudinal section taken through the boiler showing some of the parts in elevation. Fig. 2 is a horizontal section taken through Fig. 1 at a point below the pipes and their lower supporting arms, and as seen looking from the bottom toward the top of the drawing. Fig. 6 is a side elevation view of modified form. C is the boiler chamber surrounding the boiler and sustaining it in an upright position by screws f f, the chamber being provided at the top with the usual outlet for smoke and at the

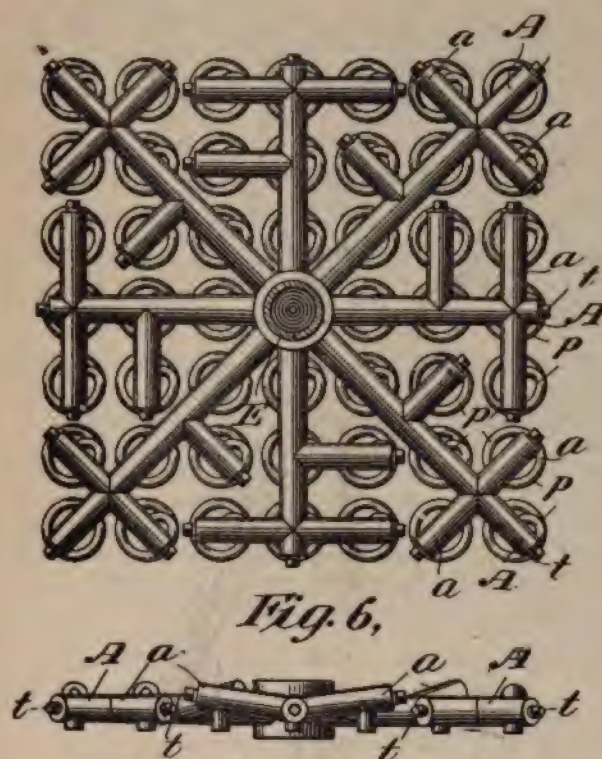


Fig. 6.

bottom with grate bars. E is a water drum constituting the main or body portion of the boiler, and acting as the support, D being a steam drum at the upper end provided with the usual steam pipes P.

F is a feed water pipe which supplies water at the base of the water drum.

A and A' are hollow spider-like boiler heads preferably of cast metal having lateral arms a a as clearly shown in Fig. 2.

t t are screw plugs in the ends of the parts A A' adapted to afford access to the interior portion of said parts to facilitate the cleaning thereof.

p, p, p, etc., constitute the pipe portions of the boiler, being of spiral shape with their opposite ends extending in alignment with the axes of the spirals and provided respectively with right and left screw threads adapted to fit in like screw threads in the parts A A', a a as clearly shown in Fig. 1, the arrangement being such that the entire strain due to expansion and contraction of the spirals is brought directly to bear upon the screw threads without any wrenching or torsional effect. This arrangement of the spiral pipes also facilitates the ready taking apart of the structure for repairs, cleaning and the like.

e and e' are interior openings between the parts A A' and the water drum E, this water drum being preferably made of three sections screw threaded into the body portions of the parts A A'.

By providing laterally extending arms a a the inventor is enabled to arrange side by side a large number of spiral pipes p, p, p, within a square or rectangular boiler chamber. Where these lateral arms are used the lower sets inclined with relation to the parts A for the purpose of affording easy access to the screw plugs t so that any one or all of the pipes may be cleaned without disturbing any portion of the boiler.

COMMUNICATIONS.

Wants Light on the Running of the Stanley Carriage.

Providence, R. I., Sept. 5.

Editor Horseless Age:

I believe that it would be interesting to us all if Mr. Stanley could be induced to write an article to The Horseless Age in regard to the actual running of his carriage upon the road.

He can do all that he claims with his own carriage, but I understand that none of his employees can yet come up to his record in running.

I know, of course, that this is mainly due to skill in throttling and pumping, but it is upon just these points that we need instruction.

The Stanleys are exceedingly busy men at this time, and it would seem that much time might be saved if they would give us an article on points in running.

The gasoline tank holds a little less than three gallons, and with this quantity of oil they can run the carriage 75 miles, but I have not heard of any one else who can do it yet.

After having a carriage less than one week, I find that I use about a gallon and a half of gasoline in 16 miles; and the water tank is then only one-quarter full. The automatic pressure regulator is set at 160 lbs. I find that in speeds up to 15 miles an hour the gauge holds steadily at 150 lbs. on good roads. It seems to me that I am using fuel to get up 10 lbs. of steam that I have no use for.

On a run of 70 miles, with one of Stanley's men who handled the carriage very skillfully on muddy roads, and with occasional rain, we made the distance in 4 hours and 50 minutes (4 hours actual running time). The water ran out at the end of the first 33 miles. We made 21 miles the first hour. Two and one-half gallons of gasoline were taken in at 36 miles. Water and 1 gal. of gasoline were put in at 60 miles. We had, I should judge, a gallon and a half of gasoline left at the end of the trip. This was a new carriage right from the factory on its way to my home, and the run was made without a single adjustment, and with nothing done to the machinery except to oil up. The carriage has not yet given a particle of trouble, but there are doubtless others who would like to be able to do as well with the carriage as the Stanleys. Therefore, it would seem to me that an article on the running of the Stanley carriage would be very useful at this time.

Yours truly,

H. P. NOTTAGE, M. D.

Arguments for the Pneumatic Cushion.

New York, Sept. 5.

Editor Horseless Age:

Permit me to reply to Mr. Graham's letter of Aug. 25, published in The Horseless Age, criticising my pneumatic cushions. I venture to question both his propositions, viz.:

"First. Air is not a cushion; it is a solid body.

"Second. Air can never be used as a spring because it is not an absorber."

Air is matter which can be subjected to contraction and expansion, and my experience teaches me that when properly controlled and in combination with other materials it is a most excellent cushion.

That air does, in combination with the form of rubber cushion which I have invented, absorb vibration is a fact that he may demonstrate to his entire satisfaction if he will take the trouble to do so.

It is far from my purpose to enter into any arguments on the two points he has raised, for I doubt not his technical knowledge and skill in these matters are greatly in excess of my own. But I earnestly desire to call attention to the claims which I make and which I have proved by long and costly experiments.

My pneumatic cushions when properly placed upon vehicles do certainly absorb vibration in a marvelous manner. I shall be happy to send some of the cushion free of cost to any manufacturer who will take the trouble to test them.

The means employed prior to my invention for obviating shocks and annoying vibrations were of such a nature as to take up the energy of impact (as by a spring, a solid block of rubber, or their equivalent) in substantially the line of direction of the impact delivered, and by subsequent reaction deliver this energy in the form of movement of a gradual and comparatively gentle nature in the same line. Prior devices, therefore, were rather palliatives than preventives. Moreover, such devices have always resulted in the production of a relatively long swing or vibration, which, while less violent and exhausting, is quite as annoying and disagreeable to a rider as mere jolting.

By use of the form of cushion which I have invented, supported and controlled in its action by the means I have devised, disagreeable shocks are destroyed and intercepted before reaching the rider in a vehicle. This occurs through the rapid expansion of an easily distended air cushion, which distention takes place in radial directions, or nearly so. In other words, the Distendable Pneumatic Cushion is so placed that the air pressure at right angles to the line of shock is free to cause the walls of the cushion to stretch, and thus renders the tensional resilience of the walls available to absorb and dissipate vibrations.

Very truly yours,

W. N. AMORY.

That Spring—Pneumatic Cushion Argument Again.

Cincinnati, O., Sept. 4.

Editor Horseless Age:

In your issue of Aug. 30, Mr. Graham makes a strong plea for springs instead of pneumatic cushions. He says: "First. Air is not a cushion; it is a solid body."

I have always been under the impression that air is an admirable spring or cushion, if properly confined and compressed. I would like to know the exact date when air became a solid body. Mr. Graham took the trouble to tell us how Webster defined resilient. If he had turned over the pages of the same volume, he would have discovered the definition of air—"Air is a fluid which we breathe, and which surrounds the earth; the atmosphere. It is invisible, inodorous, insipid, transparent, compressible, elastic and ponderable."

Now, when we attempt to breathe nails, barbed wire, elliptic steel springs, steel wagon tires, dust, etc., which are classed as solids, we experience a difficulty known not to exist with air.

Mr. Dunlop, the original inventor of the pneumatic tire, which was the means of making bicycling a more pleasant

recreation, and of bringing cycle construction within a limit of 25 lbs., evidently believed in air as a cushion.

As a rider of wheels I have tried solid rubber and pneumatic tires, and I believe the solid tire is to the pneumatic as sleeping on a board is to sleeping on a feather bed.

Why do so many builders of automobiles put expensive pneumatics on the wheels of their vehicles if springs will do the whole business of absorbing vibration?

Suppose air is a solid body, the metal in the springs is a solid also. You only absorb vibration by confining the metal in such a way that you get an immense leverage on the particles of metal tending to compress some and to separate others.

When these particles are unduly stretched or compressed they will not resume their former positions exactly, while air can be compressed to a greater extent and still return to its former conditions under ordinary usage and conditions.

"Second. Air can never be used as a spring, because it is not an absorber," says Mr. Graham. I was taught, when a boy at school, in philosophy, that if you confined air in a vessel or cylinder, and compressed two volumes into one, the tendency of that air would be to resume its former pressure. If you compress a steel spring, its tendency will also be to resume its former state.

I think the above in both cases agree with Webster's definition of resilient—"Inclined to leap or spring back; rebound."

A pneumatic cushion to take the place of springs on a vehicle could be made to feel very solid if the air was pumped to a high enough pressure in said cushion, and it would be a parallel case to putting very heavy and stiff springs onto a light vehicle. The pressure in these cushions should be pumped according to the load they are to carry.

While a single cushion, as illustrated in a recent issue, will not give as much come and go as an elliptic spring, I believe several cushions can be used piled together and thus as much scope as necessary be obtained.

We must not delude ourselves into believing that we have attained perfection in all details on running gears, etc., of motor wagons at this early date. There is lots of room, no doubt to improve in many points.

H. L. RAMBEAU.

MINOR MENTION.

William Ritchie, Hamilton, O., has completed a gasoline carriage.

The Advance Mfg. Co., Hamilton, O., have constructed an experimental gasoline carriage.

The National Motor Transit Co., which was organized to run motor vehicles through the parks of Buffalo, N. Y., has been unable to secure any vehicles.

The Western Automobile Co. has been formed at Denver, Colo., with \$10,000 capital. The incorporators are Geo. T. Emerson, William A. Perry, Geo. T. Shackleford and Morgan Edgar.

The Standard Wheel Co., Terre Haute, Ind., are considering the manufacture of automobiles. They have been making heavy wooden wheels for the electric Vehicle Co., the Winton Motor Carriage Co., the Chicago Motor Vehicle Co. and others.

LESSONS of the ROAD

Users of motor vehicles are invited to contribute to this department for the good of the industry.

An Enjoyable Automobile Tour.

Mr. and Mrs. Charles W. Lee, of Wilkesbarre, Pa., have recently made quite an extended trip in their gasoline phaeton, and have returned home more than ever enthusiastic about this way of traveling, which they have found to be the most independent and enjoyable mode of seeing the country.

Starting from Wilkesbarre, they went over the mountains to Stroudsburg, taking with ease all the heavy grades and rough roads, and ran up the famous road along the Delaware River to Port Jervis. Continuing on to Cuddebackville, they crossed the Sawangunk Mountain to Otisville, and went through Middletown, Goshen and Turners to Tuxedo Park, over excellent roads, amid beautiful scenery.

Then they found good roads through Suffern to Nyack, and crossing the Hudson to Tarrytown, reached the Sound at Port Chester, and continued along it to New Haven. Thence they ran up the Valley of the Connecticut River through Hartford to Springfield, and on to Boston, via Worcester.

For several days they made Boston their headquarters, visiting many of the charming towns and places of historic interest in the neighborhood, and reveling in the good roads which abound there. Then they visited Newport, and crossing to Narragansett, they followed the shore all the way to New York, and thence returned home.

As this was purely a pleasure trip, no effort was made to establish any record, but they averaged about 90 miles, and on one day ran 125 miles.

Mr. Lee suggests that any one to thoroughly enjoy touring in an automobile must understand every detail of his machine, carry with him tools, extra bolts, etc., and be willing to don overalls and be his own mechanic, for on any long trip over our average roads something is bound to work loose, and one is apt to be stalled in some out-of-the-way corner unless he is capable of making the necessary adjustments.

Put Himself in the Horse's Place.

Hartford, Conn., Sept. 5.

Editor Horseless Age:

Every driver of an automobile, including myself, seems at one time or another to feel called upon to point in disgust to the stupidity of the average horse when the latter becomes frightened at an automobile. I had the good fortune to hear an advocate on the horse's side of the question arguing the matter recently, and some of the things he said are worth repeating.

Speaking of the fear that some horses exhibit even when an automobile making practically no noise from its engine or gearing approaches a horse who does not see it, he said the "breathing," or slight puffing from the muffle, sounds very much like the snorting or heavy breathing of a badly frightened and violent horse, and the other horse, hearing it, thinks something awful is going on, and naturally becomes frightened.

In the case of an entirely silent motor carriage coming down the street, taking long, graceful curves and exhibiting absolutely no visible means of propulsion, my friend strikes an oratorical attitude and asks: "What would you do? Wouldn't you feel the strongest possible inclination to take to the woods if you were to see a wheelbarrow without a man coming down the street?"

Not a bad argument this.

HIRAM PERCY MAXIM.

LONDON NOTES.

London, Aug. 31.

CHARGING HYDRANT COMPETITION.

Toward the end of last year a competition was organized in Paris by a joint commission of the Syndicat Professionnel des Industries Electriques, the Association Amicale des Ingenieurs-electriciens, the Automobile Club de France, and the Syndicat des Usines d'Electricite for the best charging hydrant for supplying energy to the discharged accumulators of electric vehicles. The award of the jury appointed to consider the designs submitted, four in number, has just been issued. The report on the apparatus submitted is to the effect that as a whole the competitors have complied with the technical requirements, and that in certain cases provision has also been made for prepayment for the energy supplied. The chief fault found is the great cost of the complete apparatus, which ranges from £28 to £54, this sum not including the necessary connections. The universal connector for use with the pillars has also been less well thought out, and the judges do not consider any of the samples submitted satisfactory. One of the devices so received is apt to earth the supply, and the other may cause short circuits if not judiciously handled. Here, again, the judges complain of the cost. The prize of 400 fr. (£16) is being equally divided between La Compagnie Generale des Travaux d'Eclairage et de Force, in collaboration with La Compagnie Continentale pour la Fabrication des Compteurs a Gaz, and La Societe pour le Travail Electrique des Metaux.

THE DECHAMPS GASOLINE CARRIAGE.

For some months past hardly a week has gone by without a new type of light 2-seated motor carriage or "voiturette," as they are termed, making its appearance on the Continent. The latest carriage in this category is the Dechamps, made by the Societe des Ateliers Dechamps, of 31 Rue Frere-Orban, Brussels, Belgium. It is of a neat and attractive design, and is provided with a 2-cylinder vertical petroleum motor located in the front portion of the frame under a perforated bonnet. It is described as being capable of developing up to 4½ h.p.; the ignition is electric, the carbureter of the Longuemare type, while the cooling of the cylinders is effected by means of radial disks assisted by a small high speed fan driven off the motor shaft. Three forward speeds—6, 12 and 18 miles per hour—as also a backward motion are provided. The transmission of the power of the motor to the rear axle is effected entirely by gear wheels, no chains or belts being employed. The carriage is provided with wheels of the suspension type, fitted with pneumatic tires, and its weight complete is given as not quite 600 lbs.

THE MORISSE GASOLINE CARRIAGE.

The attention of quite a number of concerns on the other side of the Atlantic is just now centred on the production of a small two seated motor vehicle at a price which shall be within reach of a large clientele. The accompanying illustration gives a general view of a little carriage of this type which has recently been put on the market in France by P. Morisse & Co., of Boulevard St. Michel Etampes (Seine-et-Oise). France, its price being only \$500. Apart from its low cost there are several points of interest in the Morisse carriage. The "body" of the vehicle, as also the motor and transmission gear, is carried on a frame, the latter being supported



THE MORISSE GASOLINE CARRIAGE.

by springs on the axles. The gasoline motor is of the horizontal type, capable of working up to 3 h.p. at 800 revolutions per minute, the ignition is electric, while the cooling of the cylinder is provided for by means of radial ribs. The motor is located in the rear, and transmits its power through spur wheels to a countershaft. Messrs. Morisse have reversed the usual order of things, making the front wheels the drivers and the rear wheels the steerers. Three speeds, 3, 9 and 15 miles an hour, are provided, the transmission from the countershaft to the front axle being by means of chains. The power of the motor is transmitted to an intermediary shaft through one or the other of three pairs of open wheels. The intermediary shaft also carries a sprocket, connected by a chain to another sprocket on the front axle. A friction clutch is introduced in the gear, to enable the motor to be cut out and so run free. The friction clutch lever, the speed change lever and the handles controlling the ignition and the carbureter are all placed within convenient reach of the driver, while steering is effected by means of a hand wheel at the right. The carriage, which is fitted with suspension wheels and pneumatic tires, weighs a little over 300 lbs., and can, it is claimed, attain a speed of 18 miles an hour. The four sides of the body are fitted with perforated metal panels to permit a free circulation of air to the motor.

THE AUDIBERT-LAVIROTTE GASOLINE MOTOR CARRIAGE.

A French firm which has for some time been devoting attention to the construction of motor vehicles is Audibert & Lavirotte, of 12 Chemins des Quatre-Maisons, Lyons, and one of their newest types of vehicles, a four-seated mail cart, is illustrated herewith. The vehicle is provided with a 6 h.p. single-cylinder horizontal gasoline motor located centrally in the rear part of the frame. The cylinder is water-jacketed, while the ignition is electric. Three forward speeds are provided, while a backward motion is obtained by means of a cable which normally runs slack, and which can be tightened by means of a hooker pulley, controlled by a foot pedal. Belt transmission, with fast and loose pulleys, is employed from the motor to the countershaft, while from the latter to the gear wheels the power is conveyed by the usual sprockets and driving chains. The carriage can, it is claimed, attain a maximum speed of from 35 to 40 kilometers per hour and mount gradients of 1 in 10 at a speed of 10 kilometers per hour.

Steering is effected by means of the front wheels. All speed control levers are mounted on the steering standard. The gasoline storage tank has a capacity sufficient for a run of from 200 to 250 kilometers. The wheels have wood spokes and are shod with pneumatic tires.

Brown Bros., Ltd., of Great Eastern St., London, E. C., one of the largest cycle accessory jobbing concerns in England, have secured control of the patent rights in the Whitney steam carriage for the United Kingdom and colonies. Brown Bros. announce their readiness to book orders for the carriage, which is attracting considerable attention in English automobile circles, and hope to be able to make deliveries about the end of November next.

In a recent letter I referred to the legalization of the motor vehicle in the Isle of Man, that pleasant holiday resort. The Manx Cycle & Motor Car Co., Ltd., of Douglas, has not been long in getting to work, for last week they took delivery of the first of several automobiles they have on order. The carriage takes the form of a nine-seated char-a-bancs. It is fitted with a Phoenix-Daimler motor on the Panhard system, the constructors being the Motor Manufacturing Co., Ltd., of Coventry. The vehicle, which is intended for the conveyance of the public to the many places of interest on the island, has already been given several successful runs.

New public motor car services continue to spring up in all parts of the country. Such a service is just about to be started between Lincoln and Brigg, as also between South Lynn, Kings Lynn and Gaywood.

At the annual meeting of the British Association at Dover, which commences on Sept. 13, a paper is to be read by Mr. Thornycroft on "Steam Motor Vehicles." As Mr. Thornycroft is the designer and builder of the vehicles which took the gold medal at the recent trials of heavy motor vehicles at Liverpool, he is well qualified to speak on the subject.

A report is current to the effect that the Liquid Fuel & Engineering Co., of Cowes, Isle of Wight, the builders of the "Lifu" steam vehicles, are about to establish branch works in Birmingham. The present works have a capacity of thirty steam vehicles and twenty steam launches annually, the new departure being necessary in consequence of the growing demand for "Lifu" vehicles.



MAIL PHAETON, AUDIBERT & LAVIROTTE.

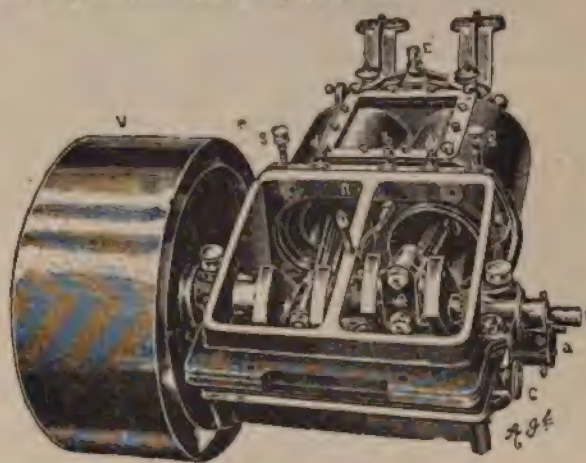
OUR FOREIGN EXCHANGES.

The Bolide Motor and Mechanism.

In the development of the petromobile, designers seem disposed to discard the vertical and longitudinally placed motor and to prefer horizontal motors, with direct driving gear—in other words, in the more recent designs a tendency to adopt locomotive practice in many things is observable. A good example of this practice is seen in the Bolide motor and gearing, of which we give some illustrations. It must not, however, be supposed that the departure in this case is experimental; on the contrary, the Bolide motor and mechanism are well known on the Continent as among the most successful systems of mechanical propulsion; indeed, till lately the record for speed was held by a Bolide motor vehicle.

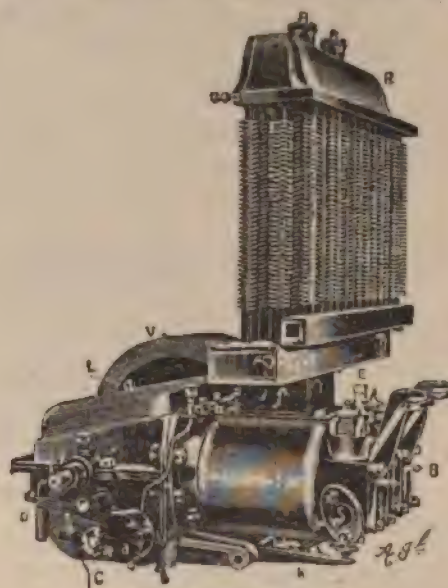
Two views of this motor are shown in Figs. 1 and 2. The motor consists of two cylinders, the outer ends of which are flanged and bolted to the crank chamber, which is made in two parts, so as to be readily accessible. The motor and its casing are thus self-contained, and form a distinct unit in the system. The motor casing is attached to the frame by a few holding-down bolts; by removing these it can be lifted up for examination without in any way disturbing the rest of the machinery. The motor works on the Otto cycle and uses

petrol as the fuel. The cylinders are 130 mm. diameter, the stroke being the same. The cranks are placed 180 deg. apart. Upon the crank shaft is mounted a broad-faced flywheel. At 700 revolutions per minute the motor gives off 15 h.p., and its weight is 242 kilogs., or 533 lbs. The ignition is effected by an electric sparking plug, the ignition apparatus being contained in an oil-tight box, a (see Fig. 2). On the second motion shaft are two cams, which alternately make contact with a vibrating spring and so close the primary circuit at the proper moment; at the same time a cam makes contact with one or the other rubbing pieces in connection with the two plugs and so allows the secondary current to pass. Mounted upon the motor cylinders is the radiator; this consists of an upper and lower chamber connected by pipes having gills attached to them. Being placed directly in front of the vehicle the radiator is very effective. It contains 23 liters of water, and during a run of 400 kiloms. the loss from evaporation only amounts to about 5 or 6 liters.

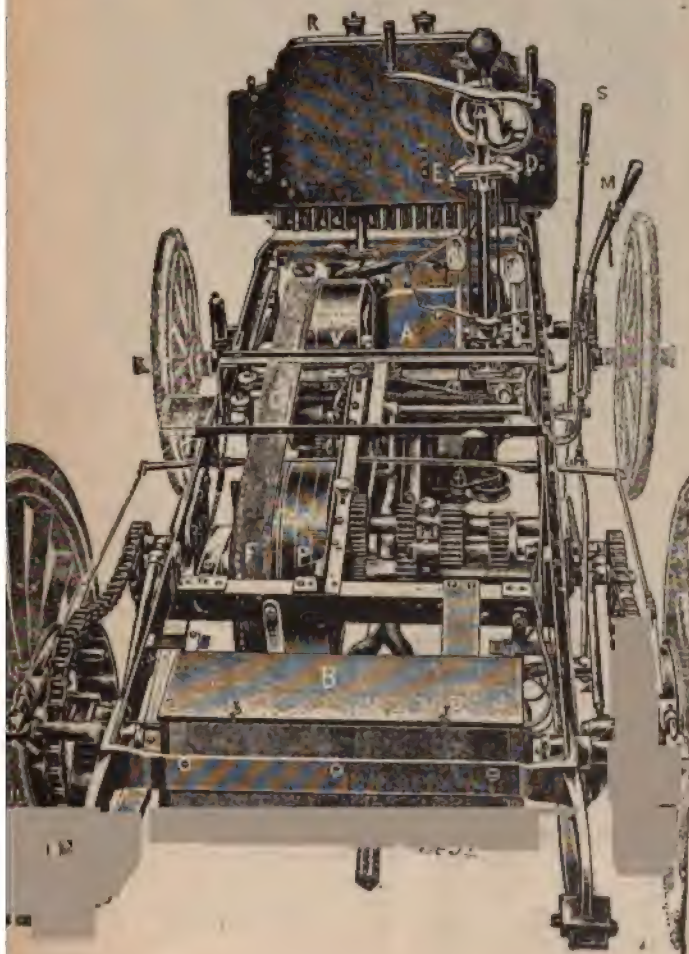


BOLIDE MOTOR.

The carbureter is of the pulverizing or spraying type, but presents no special features. A very perfect system of forced lubrication is fitted whereby all working parts are supplied by oil.

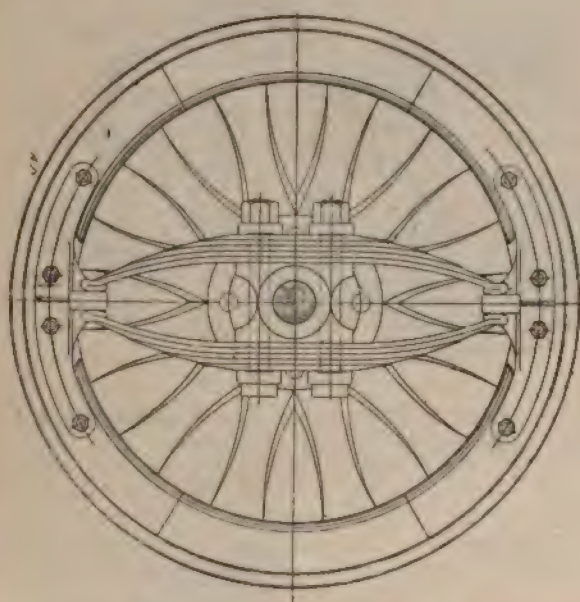


BOLIDE RADIATOR.



The following are the reference letters to Figs. 1 and 2: V, flywheel; E, stop piece for valves; g, g, d, d, and b, lubricators; n, bolt for cover; D, main shaft; a, ignition box; C, governor; R, water tank and radiator; B, sparking plugs; S, exhaust; K, control lever for exhaust valves; L, cover nut.

The framing of the vehicle (see Figs. 3 and 4) is steel plate. It is supported on the axles of the wheels by laminated plate springs. As before said, the motor and radiator are placed in front under the frame and immediately over the fore axle, which is curved for that purpose. Mounted upon the casing of the radiator is the lubricating box. On the right hand side of the frame are the change speed levers and the steering handles, etc. The motive power is transmitted from the motor by a leather belt, which passes round the motor flywheel and round two fast and loose pulleys of the same diameter as the flywheel, mounted upon the differential shaft. There are three speeds ahead and two astern. A is the cylinder, R the radiator, S the brake lever, M the change speed lever, V the pedal to the brake on the differential, C the belting, H the exhaust pipe, P the driven pulley, B box containing battery, J the steering spindle.—The Automotor.



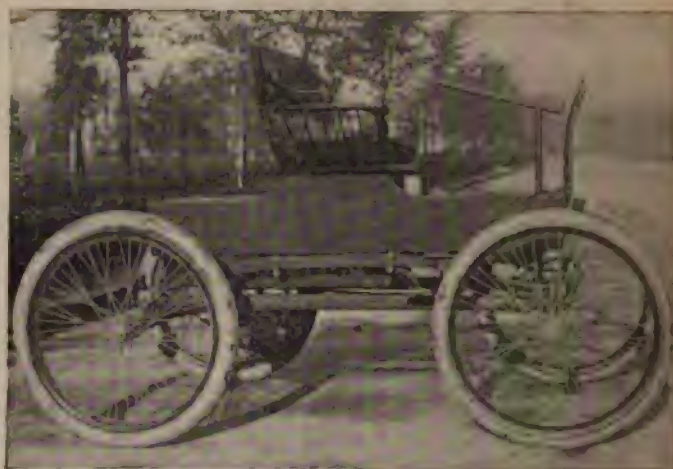
THORNYCROFT DRIVE WHEEL, SHOWING SPRING TRANSMISSION FROM WHEEL RIM TO AXLE.

The Van Wagoner Automobile.

An automobile factory is soon to be started at Syracuse, N. Y., by Chas. F. Saul and Wm. Van Wagoner, respectively president and superintendent of the Barnes Cycle Co. Both gasoline and electric vehicles will be built of similar design and appearance.

Both wood and wire wheels will be used, according to the conditions to be met and to the customer's taste, and large pneumatics will be fitted in both cases.

The carriages are said to be built on a simple plan that does away with several levers and push buttons, so that the machine can be controlled with one hand.



VAN WAGONER ELECTRIC CARRIAGE.

The accompanying cut shows the experimental carriage, which will be changed somewhat in design.



FRONT VIEW OF VAN WAGONER CARRIAGE.

Automobile Parade at Newport.

The first automobile parade under the auspices of the 400 took place at 5 P. M. Friday last at Newport, R. I. Seventeen vehicles were in line, mostly electric, though two or three Locomobiles and a Winton gasoline phaeton were noticed in line. An obstacle match similar to the tests instituted by the Paris Electric Cab Company in the training of their drivers, formed part of the day's programme. The day did not pass without accident.

The Joseph Dixon Crucible Co., Jersey City, N. J., have issued their annual catalogue, giving full information in regard to their numerous graphite products. Of special interest to the motor vehicle manufacturer are Dixon's Cycle Chain Graphite, Dixon's Special Graphite for lubricating gas engine cylinders, and Dixon's Waterproof Graphite Grease, used on drive chains, which are encased. The Dixon products are reliable and pure.

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 632463—Wheel for Vehicles.—Henry Alonzo House, Jr., of East Cowes, Isle of Wight, England. Application filed April 25, 1899.

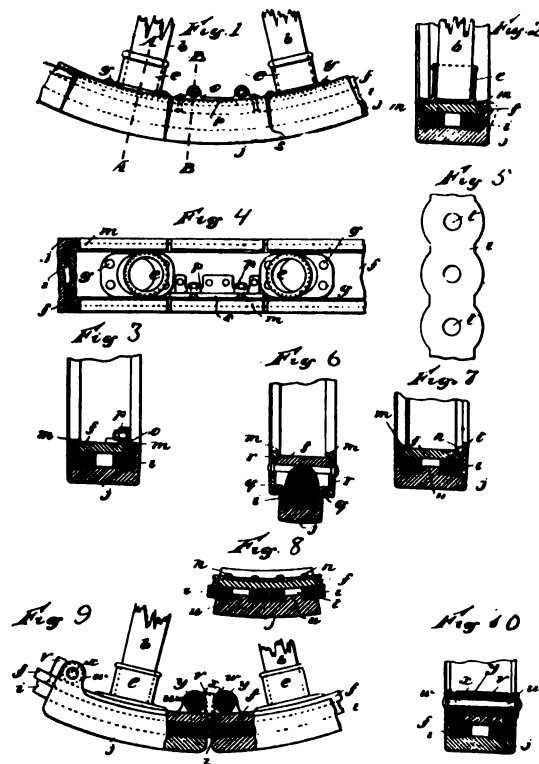
Fig. 1 is a side view of a portion of a wheel with india rubber or other suitable resilient material interposed between the inner and outer tires. Figs. 2 and 3 are sections on lines A A and B B, respectively, of Fig. 1. Fig. 4 is a plan view of Fig. 1. Fig. 5 illustrates the shape of the india rubber or other resilient material before referred to, and Figs. 6, 7, 8, 9 and 10 illustrate modifications in the tire portion of the wheel.

The outer circumference of the inner tire *f* may be surrounded with blocks of india rubber or other like resilient material *i* (shown in the drawings), held in place by an outer metal tire formed of separate trough-like segments *j*, so shaped and fitted that they inclose the india rubber blocks *i*, holding them more or less loosely to the inner tire *f*, and allow the said blocks *i* to form a resilient cushion between the inner and outer metal tires *f* and *j*. The outer tire segments *j* and the india rubber blocks *i* are held more or less loosely in place by the inwardly projecting lips or flanges *m* on the sides of the trough-like segments, which flanges *m* take under the edges of the inner tire *f*, as shown in Figs. 2, 3, and 4, or instead of the lips or flanges *m* studs or projections may be formed on the inner surface of one side of each of the trough-like segments, as shown at *n* in Figs. 7 and 8, the other side of such segment being provided with a lip or flange *m*, as shown in the same figures.

In order to enable the segments *j* to be placed in position, their sides may be sprung or bent open sufficiently for the lips or flanges *m* to pass the inner tire *f* and afterward sprung or bent inward again, as indicated at the right-hand side of Fig. 2, for example, or a gap may be made in one portion of one side of the inner tire *f* (see Figs. 1, 3 and 4), so as to enable the lips or flanges *m* on one side of each of the segments *j* to pass into place. The segments *j* may thus be threaded into position one after the other, and the before-mentioned gap may be filled up after the whole of the segments *j* are in position by a keeper-piece *o*, bolted to a bracket *p*, riveted to the inner tire *f*, or the lips or flanges of the segments *j* may in some cases project outwardly, as shown at *q* in Fig. 6, and the whole of them be kept in position by a flanged keeper-ring *r* on each side of the wheel.

The adjacent edges of the circumferential portion of the trough-like segments *j* may be so shaped by halving together, as shown at *s* in Fig. 1, for example, that the load on the wheel is transferred from one such segment to another in as continuous and regular a manner as possible.

The india rubber or other resilient blocks *i* are so shaped as to allow the same to be compressed, and also to prevent any rattle or jar of the metallic parts, whether the said blocks are under compression or not. Such a shape is indicated in Fig. 5, but same may be modified or varied, as desired.



Projections *u*, Figs. 5 and 6, are sometimes provided on the inner surfaces of each of the trough-like segments *j*, coincident with and entering more or less into the holes *t* in the india rubber or other resilient cushion *i*, in order to more or less preserve the relative positions of the segments around the circumference of the wheel, or in some cases stop-pieces *v* may be riveted to the inner tire *f*, as shown in Figs. 9 and 10, which are respectively sectional elevation and transverse section of the tire portion of a wheel. These stop-pieces *v* come between the trough-like segments *j*, which latter are furnished with lugs or ears *w*, carrying pins *x*, on which are threaded tubes or sleeves *y*, of india rubber or other suitable material, which tubes or sleeves bear against the stop-pieces *v* and tend to neutralize any jar or noise caused by the movement of the segments *j* and also preserve the relative positions of the said segments around the circumference of the wheel.

No. 632278—Self-Propelling Vehicle.—Reuben H. Plass, of New York, N. Y., Assignor to Isabella C. Plass, Same Place. Application filed Jan. 9, 1899.

The gasoline engine is so mounted as to be capable of vibrating, and has its shaft provided with a friction head; the axle is provided with two friction wheels, with which the head of the engine shaft is brought into contact. The direction of movement and the speed of the vehicle are governed, respectively, by bringing the friction head on the end of the engine shaft into contact with one or the other of the wheels on the axle and by the amount of pressure of the friction head on the shaft against the wheels on the axle.

FOR SALE.

DURYEA automobile with canopy top. Can be seen for a few days at 107 Passaic Ave., Rutherford, N. J. Price, \$450.

GILBERT J. LOOMIS,
Westfield, Mass.

No. 631,796—Storage Battery.—Harry Hower Knepper, of Chicago, Ill., assignor to the American Electric Vehicle Co., of same place. Application filed June 27, 1898.

Fig. 1 is an end view of a storage battery. Fig. 2 is a sectional view through the plates of one polarity. Fig. 3 is an end view of said plates. Fig. 4 is a view of one of the plates, showing the covering or envelop thereof partially torn away. Fig. 5 is a plan view of one of the fillers or sheets adapted to be placed between the envelops inclosing the plates. Fig. 6 is a partial view showing the envelops and fillers expanded by the electrolyte.

Envelops formed of sheets of absorbent material are provided for completely surrounding the plates of the accumulator upon the faces, edges and ends, and in the spaces between these envelops perforated fillers or sheets of absorbent material are placed, so that when the electrolyte is placed in the cell the perforated fillers, as well as the porous envelops, absorb the electrolyte and expand, thus making a compact structure, which, while effectively holding the active material in position and preventing the same from dropping to the bottom of the cell, is claimed to prevent the short-circuiting of the adjacent plates, which are usually of opposite polarity. The accumulator plates a' a'' a''' , etc., are usually mounted upon a common support or cross piece, a , carrying the terminal a^4 .

In assembling the cell the positive and negative plates are placed together, so that each plate is surrounded on opposite sides by plates of opposite polarity. Inclosing each of the plates is an envelop, b , formed of a sheet of absorbent material, as paper or cardboard, completely surrounding the faces and edges of the plate. Over the end of the plate the cap b' is provided, which completely covers the end of the plate, and in the space between the plates and resting against the cross-piece a strips of absorbent paper or cardboard, b'' , are placed, against which the caps b' are adapted to be pressed. In the spaces between the envelops thus formed one or more

fillers, c , are placed, these fillers being formed in sheets and perforated and consisting of absorbent material, as paper or cardboard made of pulp or other fibrous material. When the electrolyte is placed in the cell, it is absorbed by the absorbent envelops and fillers, causing the same to expand and completely fill the spaces between the accumulator plates. The surfaces of the plates are thus compressed between the pad-like envelops and fillers, and while serving to retain the liquid electrolyte and prevent its being spilled during the shaking and jarring of the cell they also serve to maintain the active material securely in position and prevent the falling of the active material to the bottom of the cell, which has been a serious objection to accumulators as heretofore constructed, and, furthermore, the complete inclosure of the accumulator plates by the envelops prevents the active material from shifting in position, due to the shaking and jarring, to thereby bridge across the space between the opposite plates and produce a short circuit.

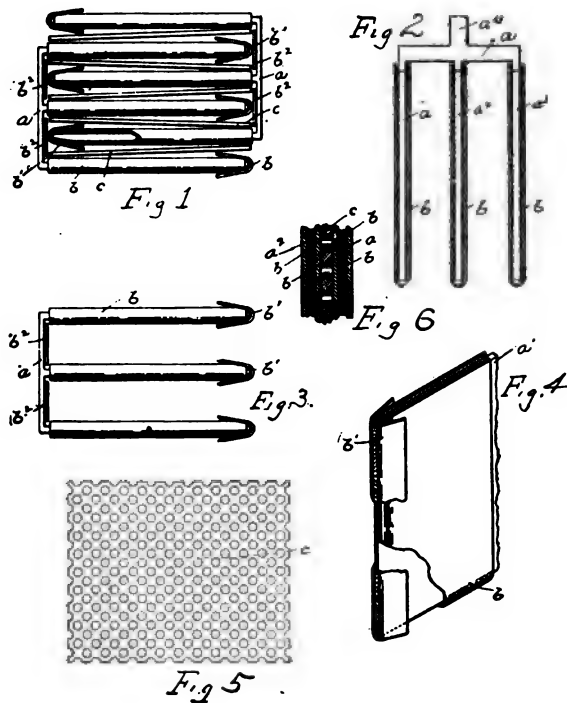
The provision of the envelops entirely surrounding the plates on the faces and edges and the complete filling of the space between the plates with absorbent material is said to entirely overcome the difficulty of dropping of the active material. The perforation of the fillers c forms inclosed receptacles for the liquid electrolyte, thus permitting the employment of a great deal more of the electrolyte than could be present if the fillers were solid, and, furthermore, due to the presence of these bodies of liquid, the internal resistance of the cell is greatly diminished.

No. 8,493—Improvements in Belt Tightening or Slackening Devices for Use on Automobile Vehicles.—Edouard Alexis Vivinus and Auguste Jules Hecht, Schaerbeek-lez-Bruxelles, Belgium. Application filed April 22, 1899.

This belt tightening or slackening device enables a person to tighten or slacken the transmission belt or belts without dismounting from the vehicle.

The frame of the vehicle is movably suspended from one of two axles (preferably from the rear axle) in such a manner that the position of this axle relatively to the frame can be varied by means of a system of levers actuated from the seat of the vehicle; these two parts are each rigidly connected with one portion of the transmission gear, so that their separation or approach, resulting from movement of the axle relatively to the frame, have as a consequence the tightening or slackening of the belt or belts actuating the axle in question.

The frame V of the vehicle, on which the fixed motor M driving the pulley P^1 , is suspended from the axle A by springs R (one on each side of the carriage) which are supported by links J J , so arranged as to form with the spring a parallelogram and consequently be able to simultaneously take up a certain forward or backward inclination and allow of a movement of the axle A relatively to the frame or vice versa. The axle A forms a part of the transmission gear T , comprising gear wheels E E^1 and pulley P , connected to the pulley P^1 by means of the transmission belt C , which is to be tightened or slackened by the device now being described; the pulleys P^1 P constituting the two ends of the transmission gear and the parts which are to be separated from or approached toward one another. This movement is effected by means of the tightening device proper, which comprises a lever B placed within reach of the driver and connected by a rod D to a projection on the axle A , which is to be moved. The lever B has a fixed fulcrum at U on the frame V , which is a fixture on the front axle in the ordinary way. The operation of the apparatus is as follows:



The position I of the lever B, shown in the drawing by full lines, corresponds to a position of the transmission gear in which the belt C is slackened.

To tighten the belt the lever B is pushed forward to position 2, shown in dotted lines, which will cause by the movement of the connecting rod D a backward movement of the axle A with its springs R, and all that portion (E E' P) of the transmission gear which is rigidly connected with this axle; the links J J inclining backwards (from position 1 to position 2). The movement of the axle A, and therefore of the pulley P (to position 2, shown in dotted lines), has the effect of tightening the belt.

When it is required to slacken the belt again the lever B is moved from position 2 to position 1, and the axle A will be brought forward, the links J inclining forward again.

This tightening device may be applied to one or more transmission belts actuating the driving axle of the carriage directly or to an intermediary transmission gear.

No. 6,604—Improvements in Electric Igniting Apparatus for Explosion Engines.—Pope Mfg. Co., Hartford, Conn. Application filed March 27, 1899.

This invention has for its object particularly to make it possible to employ an alternating current and to dispense with the use of primary batteries. A further object is to make it possible for the operator or driver to vary the period of ignition at will. Another part of the invention is concerned also with the means whereby the period of ignition is varied, the object being to permit the operating handle to be located on one part, such as the body of a motor vehicle, which changes its position with respect to the other part of the motor vehicle, on which is mounted the explosive engine and the igniter, while at the same time the adjustable part of the igniter responds promptly and precisely to the movements of the operating handle, and is not affected by the relative displacement of the two parts of the vehicle.

Fig. 1 is an enlarged side view of a motor showing the flexible control to the igniter.

Fig. 2 is a vertical section of the igniter and its connected parts.

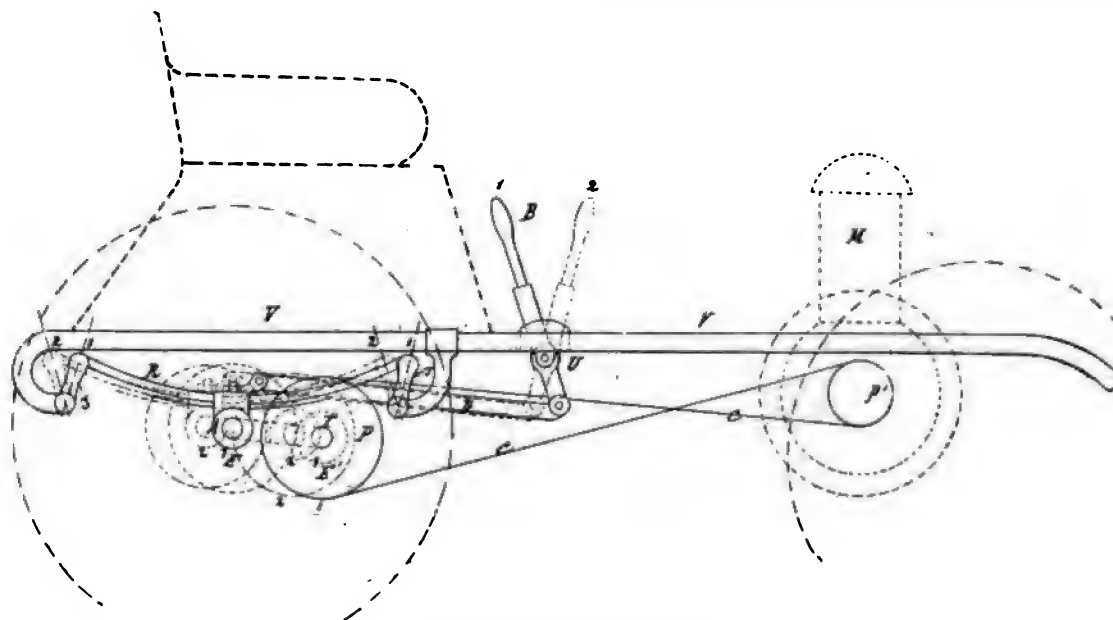
Fig. 3 is a plan view of the same.

Figs. 4 and 5 are detail views of the contact making and breaking devices in side and plan view.

Fig. 6 is a diagrammatic representation of the electrical connections of the igniter.

The igniter and its operating means are inclosed within the casing E' E', or within a supplemental casing secured thereon. A permanent magnet is mounted rotatably within the casing and is driven by suitable gearing from the engine shaft so as to rotate in a definite relation therewith, preferably at the same speed in a two-cylinder engine, the gearing shown being adapted to produce such relative speed. The armature L is wound for an alternating current, and for every revolution of the two-pole field about the armature the current generated will vary from zero to maximum positive, and then through and from zero to maximum negative.

To make it possible for the operator to vary the period of ignition at will the armature L is made rotatably adjustable to a limited extent, being supported by a cap L', which is rotatable on the main part of the casing. The devices for taking off the current at the proper time, for a multiple cylinder engine, are carried by two insulating disks M and N, which are secured respectively to the field or permanent magnet and to the armature, the disk N being of course capable of movement with the armature for purposes of adjustment. Upon the disk M are secured contact plates m, which are disposed at proper points, although the apparatus might be used with one only or with more than two. The disk N carries a pair of separated contact fingers n n', through which the circuit is closed by the contact of plate m at the proper time, the said contact fingers being connected in circuit with the proper sparking device, indicated at O in Fig 6, and the secondary winding of the induction coil P. The primary winding of the coil is connected with the armature winding, preferably through a condenser or a vibrator, as indicated at P'. The contact plate or plates m being properly placed, it will be evident that the alternating current generated will be taken off as it approaches its maximum when it is of sufficient intensity, and will be delivered to the sparking device through the described



BELT-TIGHTENING MECHANISM.

connection or otherwise. The period can be varied or adjusted at the will of the operator by the rotary adjustment of the armature, which not only varies the point where the contact plate *m* bridges the connection between the fingers *n* *n'*, but also varies slightly the point at which the current reaches its maximum phase.

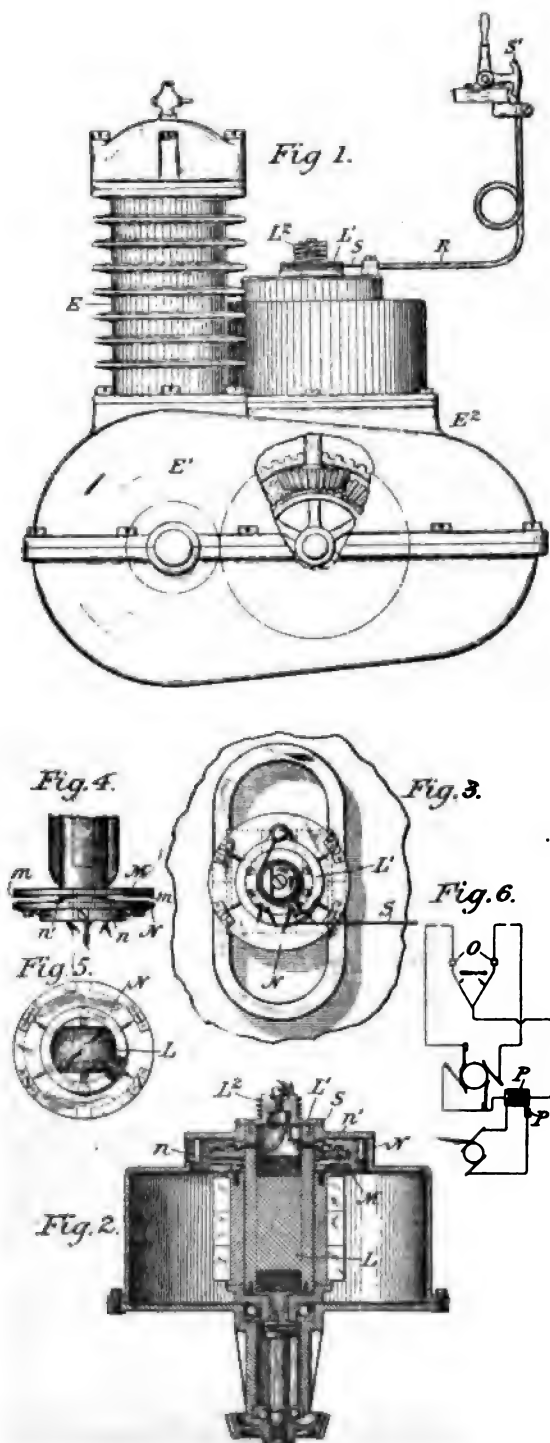
A hard but moderately flexible tube *R* is extended from the actuating handle to or nearly to the point of application of the movement of the handle, one end of the tube being secured in

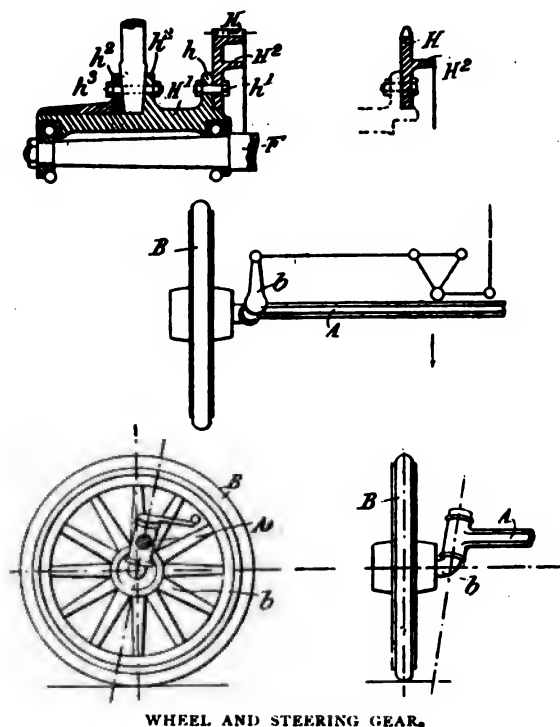
fixed relation to the part to be removed, which in this case is the armature *L*, while the other end is secured in fixed relation to the actuating handle or actuator. This tube is not extended in a direct line between these two parts, but is preferably bent or coiled between its ends so as to take up any relative movement of its two ends without any variation in the length of the tube. There is thus formed a fixed path of determined length for a flexible connector *S*, which may be a wire, one end of which is connected to the handle or actuator *S'*, while the other end is connected to the part to be adjusted, or in this case to the cap *L'*, which supports the armature *L*. Since this connector is retained always in a path of the same length, notwithstanding any change in the relation between its ends, a determined movement of the actuator will invariably produce a corresponding movement of the armature or other part to be adjusted. In the present case a spring *L'* is applied to the armature to return it to its initial position when the handle is moved to permit it.

No. 6,006—Improvements in Motor Road Vehicles.—Pope Mfg. Co., Hartford, Conn. Application filed March 20, 1899.

This invention relates particularly to an electric delivery wagon. One special object in view is to produce an improved interchangeable running gear which can be applied readily to any ordinary form of body, the front or steering part of the running gear and the rear or driving part being wholly independent the one of the other, so that the running gear can be applied to any vehicle body regardless of its length. Another part of the invention relates to the support and inclosure of the driving mechanism, the casing being so constructed as to secure the greatest strength at the points of greatest strain, and so related to the running gear that the transmission gears shall be maintained always in absolute parallelism, axially and properly intermeshing; furthermore, the construction of the casing and its relation to the driving mechanism permits the casing and the driving mechanism to be removed as a whole without requiring the casing to be opened. A further object is to improve the construction of the hubs of the driving wheels so that absolute concentricity of the driving gear, whether spur or sprocket, with the axis and bearings can be assured. Absolute concentricity of the brake drum with the driving gear, and consequently with the wheel, is also said to be effected by forming the brake drum in one integral piece with the gear, the brake surface and the gear being formed on opposite sides of a common flange or upon separate flanges. The brake itself also forms a part of the invention, the object specially in view being to secure good clearance between the brake and the brake surface when the brake is not in use.

The driving mechanism comprises an electric motor *I* having a hollow armature shaft *i*, an ordinary balance gear *K*, not necessary to be described herein, but connected with the armature shaft *i*, a two-part driving shaft *L*, the parts of which are connected respectively with the corresponding parts of the balance gear, and driving pinions *l* upon the outer ends of the driving shaft, which pinions mesh respectively with the driving gears *H* above referred to. It is essential in order to reduce friction in use, and especially to prevent stripping of the teeth of the driving gears and pinions, that the driving shaft and its pinions be maintained always in absolute parallelism with the axis of the driving wheels and their gears, and that there be the least possible play between the intermeshing pinions and gears. The frame or support for the driving mechanism has been devised with especial reference to these requirements, as well as with a view to the proper protection

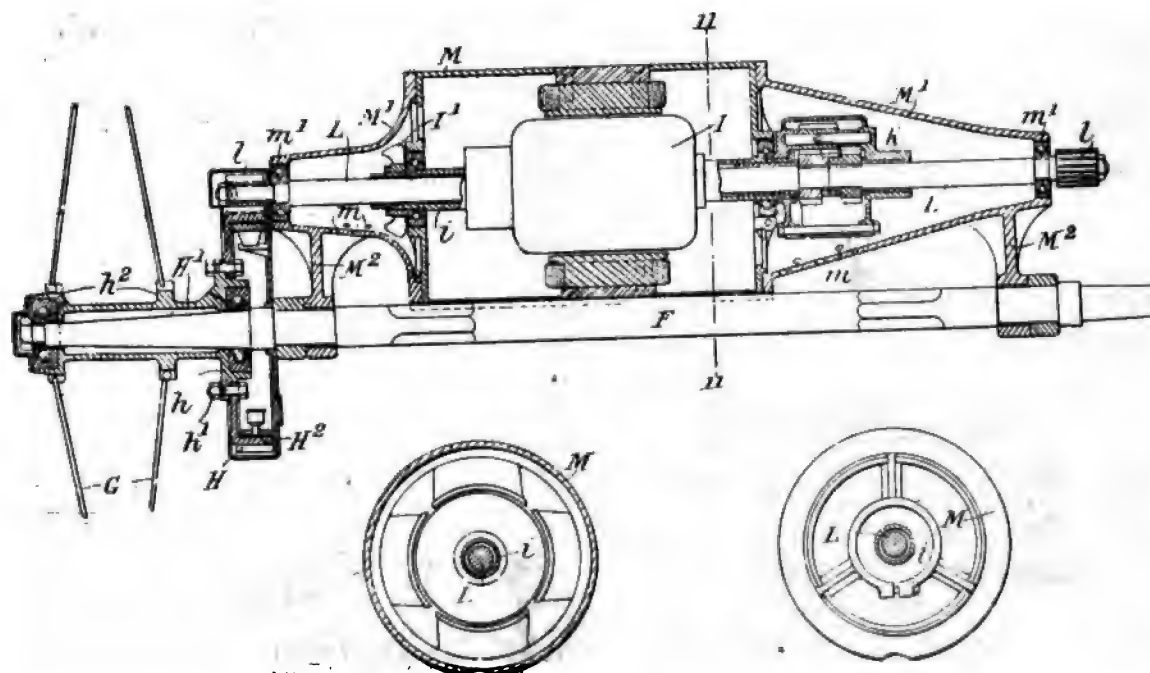




WHEEL AND STEERING GEAR.

of the driving mechanism, to compactness and lightness in construction, and to the easy detachability of the driving mechanism and its support as a whole. With these objects in view a casing is provided for the driving mechanism, which casing consists of a middle portion M of substantially uniform section which may have the motor fields secured rigidly to itself, and two reduced portions M', one of which supports or incloses the balance gear, while the other furnishes a

chamber for a ventilating fan. The ends of the middle section M are formed with spiders, which support the bearings for the hollow armature shaft i, while the extremities of the reduced end portions M' immediately support the bearings m' for the driving shaft L, as close as possible to the pinions which are secured to the driving shaft just outside of the casing. Arms M², which are formed integral with the reduced portions of the casing near the outer ends thereof or are secured thereto by means of sockets integral therewith and transverse to the axis of the casing, are mounted upon the fixed rear axle F, and through their proximity to the bearings of the driving shaft within the casing maintain said driving shaft in absolute parallelism with the rear axle and consequently with the axis of the driving wheels and gears mounted thereon, and permit the least possible play between the driving pinions and the driving gears, while at the same time the driving mechanism may be supported on the other side with a reasonable degree of flexibility, since whatever movement the driving mechanism has in consequence of such flexible support will be always concentric with the axle, wheels and driving gears, whereby the meshing of the driving pinions with the driving gears will be in no wise affected. On the other side of the casing and making up with the casing and with the arms M², the support or frame for the driving mechanism is an arm M³, which rests upon or is secured to the spring bar E³, thereby affording a connection between the frame or support for the driving mechanism and the spring system and providing for such driving mechanism on one side a flexible or yielding support. Orifices m are provided in the end portions of the casing, and a free passage for currents of air is afforded through the open spiders of the middle section M of the casing and the spaces between the field spools of the motor, the circulation of the air being promoted by a suitable fan I' secured to the end of the hollow armature shaft i. The casing, which is in form somewhat like a torpedo, constitutes in effect a truss which, being suspended at its ends and having its greatest



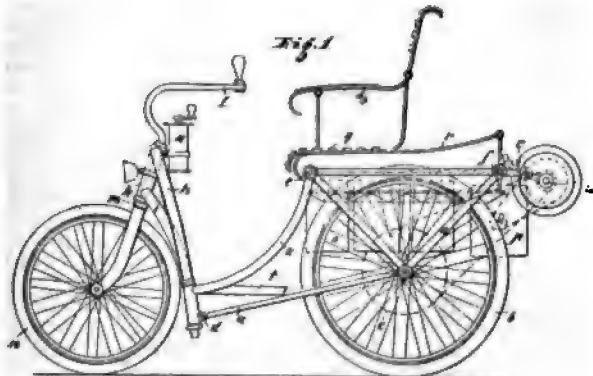
DRIVING MECHANISM.

section in the middle, secures the greatest strength in the line of the greatest strains with the minimum of weight, serving the double purpose of casing and support.

Commonly the driving gear is secured to the spokes of the wheel by clips, and with such construction it is not easy to secure nor to maintain the desired concentricity. According to this part of the present invention the hub H^1 of each driving wheel has formed integrally therewith a flange h , which can be machined or finished in the same operation with the hub itself, and therefore brought to absolute concentricity with the hub, and to this flange the driving gear H can afterward be secured by bolts h^1 or otherwise, whereby the gear will be easily and permanently secured in absolute concentricity with the hub. The hub H^1 is provided also with integral spoke flanges h^2 for engagement with wire spokes. In the construction, which is adapted for wooden spokes, with a filling of wood between the outer portion of the hub and the bearing portion thereof, one of the flanges h^2 is formed upon the separate part of the hub, and is secured to the other flange h^2 with the spokes between them, by bolts h^3 .

For the proper action of the brake it is also desirable that the brake drum should be concentric with the wheel or other part to which it is applied, and to attain this result, as well as to promote convenience in manufacture, the brake drum H^2 is formed integral with the driving gear H .

No. 11,685—Improvements in Motor Cars Driven by Electrical or other Motive Power.—Wilhelm Muller, Berlin, Germany. Application filed June 5, 1899.



The object of this invention is a motor car for electrical or other motive power, the frame of which is superior to those that have been constructed for the same purpose, on account of its lightness and its special form of construction being adapted for the attachment of electric battery or other kind of motor. On account also of the way in which it is put together, it admits of being very readily taken to pieces for the purpose of storing, for instance, in a dwelling room if required.

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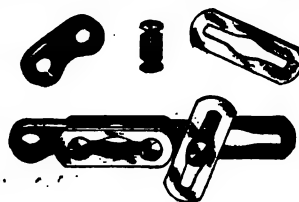
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VOLUME 4

SEPTEMBER 20, 1899

NUMBER 25

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Evolution of the Motor Vehicle as Shown by Patents.
By Leonard Huntress Dyer. Part 2, Steering Gears, page 10.

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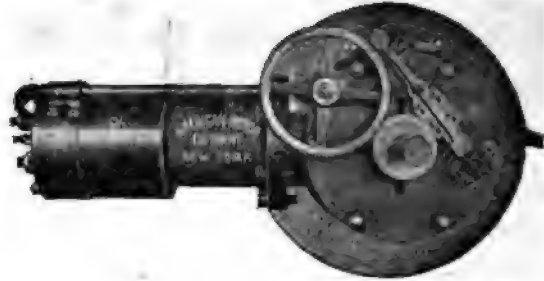
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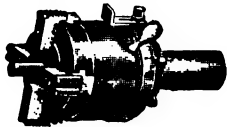
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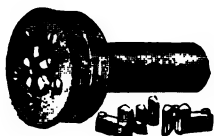
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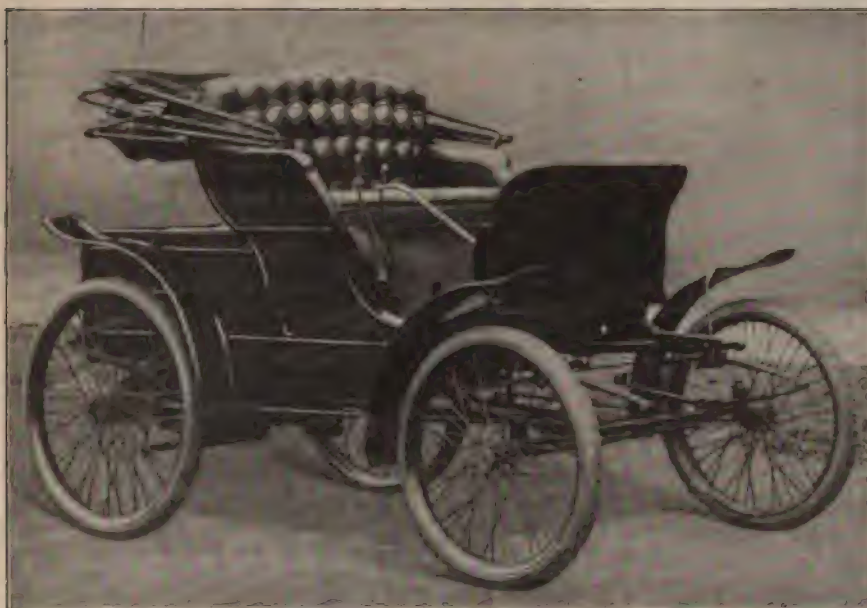
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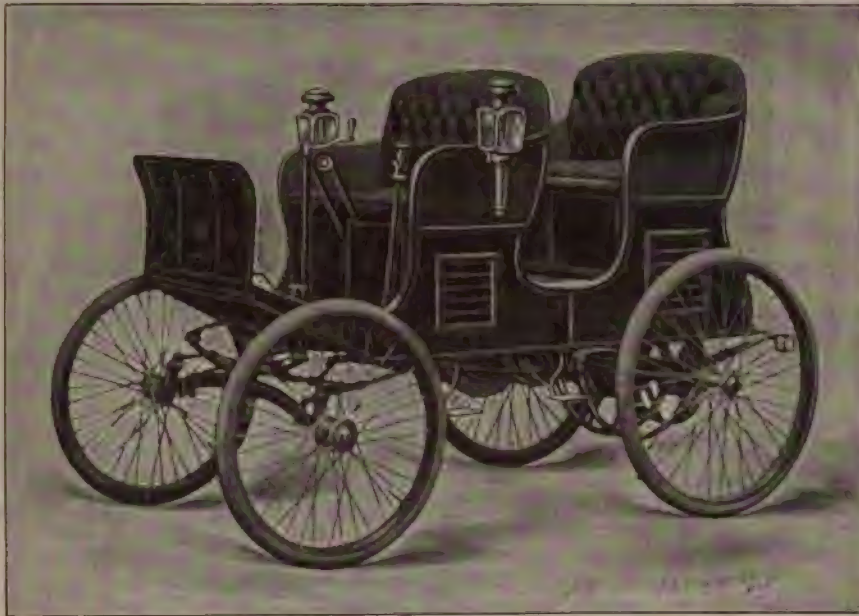
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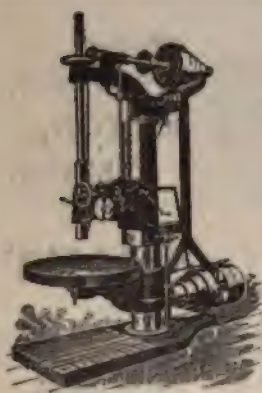
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DEVOTED TO MOTOR INTERESTS

VOL. IV.

NEW YORK, SEPTEMBER 20, 1899.

No. 25.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:

AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET,
NEW YORK.

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COMMUNICATIONS.—The Editor will be pleased to receive
communications on trade topics from any authentic
source. The correspondent's name should in all cases
be given as an evidence of good faith, but will not be
published if specially requested.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

**On account of the excessive discounts charged
by New York banks on small checks under their
new rule, subscribers are requested to remit by
Post Office or Express money order or N. Y. draft.**

Liquid Air Absurdities.

The liquid air boomers are overdoing the matter. The Boston company whose prospectus was referred to in our last issue has been a perfect target for the technical press during the past week. Its patents have been declared non-existent or valueless, its engineers and inventors have been shown to be ignorant of the subject, and it has been asserted by reputable authorities that these audacious stockjobbers do not even know how to make liquid air, and are at their wit's ends for a source of supply for experimental purposes.

The illustrations of liquid air automobiles shown in the company's prospectus are merely washed drawings taken from some carriage builder's catalogue without visible change in construction to accommodate the mysterious propelling agent. The statements made therein are amazingly false. For example, it is said that electricity and compressed air have, until the present time, succeeded almost all other forms of power for

automobiles. The pictures of carriages are called demonstrations of the system. Ridiculous claims are made for a variable speed power transmitter, which is nothing more than a pair of extensible cone pulleys, described over a year ago in The Horseless Age, and often before devised for other purposes. To transmit power enough to drive a carriage they would have to be very bulky, and lack the positiveness required for this work. A flexible shaft—the most convenient form of connection for such "demonstrations"—is represented as conveying the power to the rear axle.

Throughout the entire agglomeration of falsehoods not a word is said in explanation of any system of producing liquid air. The whole effort of the spellbinder who was hired to prepare it is to center attention upon the graceful pictures and the disgraceful exaggerations that accompany them.

The brazen effrontery of this prospectus is unsurpassed in the annals of "fakedom." That thousands of dollars should have been invested on such a presentment appears incredible, but the editor is so informed. Verily, we have touched the very base string of credulity.

Nickel Steel Axles and Shafts.

The axles and shafts employed by motor vehicle manufacturers are not always reliable. Only recently several cases of breakage have come to the editor's notice. In one of these instances the inventor had had a number of years' experience as a designer of motor carriages, but had not learned, it seemed, that the best material for a motor carriage driving axle or the driving shaft of a motor is nickel steel, the toughest steel made and comparatively inexpensive when its great superiority for this purpose is considered. No other kind of steel known to science will stand the shocks and constant vibration of road work so well as this. Other steels crystallize and weaken under the strain. Nickel steel retains its structure nearly unimpaired.

The Hysterical Period.

The speed craze and the cheap craze seem to be simultaneously spreading. If there is lack of knowledge on the subject of weights, there is equal ignorance on the subject of price, for light and cheap are synonymous terms in the motor vehicle industry of the United States to-day.

For strength and durability in a motor carriage, weight is essential, and abundance of good material means a higher cost than poor material sparingly used.

The public have been cruelly misled by inventors and promoters, and are largely in the dark as regards weights, price, speed, etc., but a season's experience on the road will do more to correct these erroneous ideas than any amount of disinterested advice from the editorial chair. Enthusiasm and reason do not harmonize. Where one is the other is generally absent, and so it is with the public, who will not begin to understand the motor vehicle until they have recovered from the violent fit of hysterics into which promoters have thrown them.

Bearings.

Bearings should be proportioned to the load they are to carry or the work they are to do. If the normal load carried is accompanied by shocks, and strains of varying direction and intensity, there is all the more reason for an ample bearing surface. Motor and axle bearings are certainly of this kind. The normal load carried may not be large, but the unusual strains to which the load is subjected are a severe tax on the bearings and render a large surface imperative. Some of the most popular makes of motor carriages now on the market have bearings so small that durability is out of the question from this cause alone.

Facts and Figures.

E. J. Stoddard, a mechanical engineer, who has given much study to the gas engine, is contributing to our columns technical articles on this subject, unfortunately little understood in the United States to-day. The articles show a great deal of painstaking research, and if our readers will study them carefully many of the questions that find their way to our query department will be spared. Valuable data for comparison are found in the article on "Proportioning Otto Cycle Gas Engines," appearing in this issue. It is material of this kind that is needed to bring the motor movement down to earth and keep it there until it develops an industry. Industries are based on facts and figures, not on rant and fable.

The far-reaching ramifications that spring from the parent stem of a new industry are well shown by the paragraph from our London correspondent referring to portable motor sheds

or houses for automobilists who have no stabling accommodations of their own and wish to improvise one of just sufficient proportions to house a vehicle safely. It is one of those unexpected yet useful anticipations of public demand which are brought to light with every new industrial movement, and of which the motor industry will doubtless furnish many examples.

We commend to those of our readers who are of an inventive mind the close perusal of Mr. Dyer's series on "The Evolution of the Motor Vehicle as Shown by Patents." An inventor should be familiar with the history of the art he seeks to improve. Most inventors are not, and to this cause we may ascribe much of the unprofitable labor bestowed on devices already patented, unpatentable or impractical.

The Automobile Parade.

We reproduce a few views taken at the floral automobile parade in Newport on Sept. 8, when society turned out in gorgeous array to do honor to the new mode of locomotion. Money was lavishly spent in the decoration of the carriages, which were covered with flowers of all kinds and colors, lanterns, doves, eagles and other ornamental designs being added in many cases.

Prizes were awarded for speed, decoration and skill in manœuvring. The first prize for speed was taken by W. K. Vanderbilt, Jr., with a "Locomobile" steam carriage; the first



WM. K. VANDERBILT, JR.—STEAM "LOCOMOBILE."



MRS. OELRICHS IN HER COLUMBIA ELECTRIC VICTORIA.

prize for decoration was awarded to Mrs. Herman Oelrichs, and the second to M. M. Shoemaker, both Columbia electric carriages. Stuyvesant L. Leroy took the first prize for skillful driving.

Many of the operators of the electric carriages were ladies.

Transcontinental Tour Resumed.

It is reported that Mr. and Mrs. Jno. D. Davis, who started out from New York for San Francisco about July 13, in a motor carriage, and were stalled at Toledo, O., for repairs and by an attachment taken out on the carriage by an Eastern creditor of the Davises, have resumed their journey westward.

Taking Up Gasoline Again.

The Columbia & Electric Vehicle Co., of Hartford, Conn., who have been devoting most of their attention to electric vehicles for the past two years, have turned to gasoline again with renewed energy, and are experimenting with every known type of gasoline motor both in the shop and on the road. It is said to be their intention to put a full line of gasoline vehicles on the market soon.

LONDON NOTES.

ENGLISH RACING BLOOD UP.

London, Sept. 7.

Considerable excitement has prevailed in English motor circles this week owing to the success of British chauffeurs in the Paris-Ostend race. This is the first time that English automobilists have competed in any of the long French races, and their success against such practiced racers as Charron, Girardt, Lemaitre and others has made us proud of the Hon. C. S. Rolls and the Hon. J. Scott Montagu, M. P. The former, it is true, rode a French Panhard, but the latter drove his usual Daimler touring cart, without any alteration whatever. One result of the race has been to induce the Daimler Motor Co., Ltd., of Coventry, to take up the manufacture of racing carriages, and they are building a special one for the purpose of competing in the projected Paris-St. Petersburg race, as also in other important 1900 races on the Continent. In short, the carriage in question is intended to bring to English builders the credit of the fastest carriage in the world, for if it fulfills expectations a challenge is to be sent to the French Automobile Club for a race for the Gordon Bennett International Cup.



ROGER WINTHROP'S WINTON GASOLINE PHAETON.

PORTABLE MOTOR CARRIAGE SHED.

Following in the wake of motor vehicles, quite a number of accessories and adjuncts are naturally coming. One of the latest accessories is a portable motor storehouse, specially intended for those automobilists who have no permanent stalling accommodation. A house of this kind has just been put on the market by F. Jackson & Co., Ltd., of 77 Oxford St., London, W. The house, intended for a Benz carriage, is constructed of wood, has a ridge roof and two large outwardly opening doors in front. The inside walls are all lined with felt to render it waterproof, the dimensions of the shed being 8 ft. 9 in. by 6 ft. by 7 ft. 9 in. To facilitate the entry of the carriage, two folding ramps are fitted, while a folding bench is also provided, on which any small repairs can be carried out. In addition there are a number of small shelves for the storage of tools, accessories, etc. The firm intend to make the houses of any size suitable for any type of motor vehicle.

THE BERLIN EXHIBITION.

A very large exhibition of motor vehicles was opened in Berlin on Sunday last, the 3d inst. Exact particulars are not to hand, but I understand that there are quite a large number

of German firms exhibiting, while the French and Belgian sections make an imposing display. Germany has hitherto not been to the fore front in the motor movement, but there are signs of an awakening. In connection with the show, a number of intertown races are being organized, and these should do much to bring under the notice of the *Deutsche* the capabilities of automobiles.

THE TURGAN-FOY MOTOR CARRIAGE.

At the recent motor exhibition in Paris an interesting little vehicle was shown by Turgan & Foy, of *Les Ateliers de Constructions Mechaniques*, 96 Rue Carnot, Levallois-Perret, France. The motor is of the horizontal two-cylinder, gasoline type, capable of working up to $4\frac{1}{2}$ h.p. The two cylinders, which are provided with radial ribs for cooling purposes, are arranged opposite to each other, the piston rods working on to a central crank shaft, the two cranks being fixed at an angle of 180° to each other. A new departure to be found in this carriage is that the crank shaft is vertical and drives by means of pinions a second vertical shaft, which not only acts as a cam shaft actuating the exhaust valves, but also carries a large horizontal fly wheel. Two belt pulleys are also mounted on the motor shaft, connected by belts to two pairs of corresponding



GASOLINE CARRIAGE OF TURGAN & FÖY.

fast and loose pulleys on a vertical countershaft at the rear of the vehicle. From this countershaft the power is transmitted to the rear axle through one or other of two sets of bevel gears inclosed in a gear case. Four forward speeds are obtainable, two by means of the belts and two by the duplicate bevel gear transmission at the back, there being two distinct levers. The ignition of the explosive charge is effected by an electric spark. The frame of the carriage is built up of steel tubing, and is supported on the axles, which are hollow, by strong springs. The wheels are of the suspension type, shod with pneumatic tires. Steering is controlled by a small hand wheel at the side, while there are two brakes, both operated by pedals, one acting on a drum on the differential gear and the other on the hubs of the rear wheels. The weight of the two-seated carriage complete is stated to be 450 lbs.

HUMBER CO. TO MAKE ALTHAM MOTORS.

Humber & Co., Ltd., of Coventry and Beeston, have secured from the trust company which bought the Altham motor patents for the entire world with the exception of the United States the exclusive right to manufacture these well-known American motors for stationary, marine and vehicle purposes, and will immediately begin to produce the motors and motor vehicles propelled by them. Mr. Altham, who has been in London for some time past in connection with this deal, will return next month.

It is interesting to note that many carriage builders in England are awakening to the fact that unless they keep pace with the horseless vehicle movement they are likely to be left behind. One of the most enterprising concerns in this direction is H. Mulliner Co., Ltd., Brook St., London, W. When I called at their place the other day I found fully a dozen motor carriages either being provided with bodies or being refitted, as regards the carriage builder's part of the work. Among the interesting vehicles I had an opportunity of inspecting was a convertible motor quad-tricycle for Mrs. Langtry, the well-known actress, and a neat three-seated dog-cart, the frame of which, together with the motor and transmission gear, was built by the Endurance Motor Co., of Coventry. Messrs. Mulliner have enough horseless vehicle work at present on hand to keep them fully employed right up to the end of the year.

The Eadie Chain Co., of Redditch, have brought out a twin-roller chain of $1\frac{3}{4}$ -in. pitch, which, as the result of a test made at the Mason College, Birmingham, is shown to have a breaking load of about 4,614 lbs.

It is reported that a gentleman in Athens has secured a 30-years' concession to operate horseless vehicles for public transport purposes in Greece.

Toward the end of last year two French automobiles were sent out to Africa as an experiment. The trials have apparently proved successful, as a company has just been registered in Paris with a capital stock of \$200,000, under the style of the Compagnie des Transports par Automobiles au Soudan Français, the object of the company being sufficiently denoted by its title.

The Daimler Motoren Gesellschaft of Cannstatt, Wurtemberg, has just commenced the construction of racing carriages, to be fitted with motors of no less than 24 h.p.

The French rights in the "Locomobile" of Newton, Mass., have been secured by the American Automobile & Motor Co., of 47 Boulevard Hausmann, Paris.

A service of public electric omnibuses was inaugurated in Berlin on Sunday last. The company, which was formed in London some years ago for a similar purpose, appears to be as far off as ever, for the London electrical omnibus is still conspicuous by its absence.

It has just transpired that in connection with the autumn manoeuvres, some officers at Aldershot desired to test the capabilities of motor vehicles as an adjunct to military equipment, but such desires were not allowed to be fulfilled, owing to orders being received from headquarters that such experiments were not to be permitted.

New works for the construction of motor carriages are being established at Willesden, near London, by W. C. Bersey & Co. The head of the new firm has been prominently connected with the London Electrical Cab Co., but in the future will devote his attention to oil and steam vehicles, as well as those propelled by electricity.

The annual Stanley Cycle Show is to be held in the old locale at the Agricultural Hall, London, from the 17th to the 25th of November next. For two or three years past this show has, in addition to cycles, comprised an automobile section, and it is announced that this year this department is likely to be of a very imposing character.

The success of the public motor vehicles at Newcastle-on-Tyne has induced a gentleman in that city to organize the North York & South Durham Motor Car & Bungalow Syndicate, Ltd., to establish similar services from Stockton and Middlesbrough to various places in the district. It is intended to develop the services as time goes along, while as a start the syndicate has placed an order for eight large motor carriages, each capable of carrying ten persons, the recipients of this large order being the Daimler Motor Co., Ltd., of Coventry.

Happening to be passing the offices of the British Motor Coupé Co., in North London, yesterday, I had an opportunity of examining a large new motor vehicle, having seating accommodation for no less than twenty persons. The vehicle takes the form of a char-a-banc, and is the largest of the type in England. Inquiries elicited the fact that it had only arrived that day, that it was constructed by the German Daimler Co., and that it has a 10-h.p. 2-cylinder gasoline motor, four forward speeds and one astern motion.

The exhibition of motor vehicles at Dover, which is to be held this month in connection with the visit of the British Association to that town, promises to be of an important character. All the leading English builders of motor vehicles, as also several French firms, have taken space. The British Motor Coupé Co., of London, are sending down a lot of carriages to ply for hire in the town during show week, having secured the sole right for this work.

Evolution of the Motor Vehicle as Shown by Patents.

PART 2, THE STEERING GEAR.

By Leonard Huntress Dyer.

(Continued from page 7, issue Sept. 6.)

The best modern practice tends to abolish the pivoting of the entire front axle, and in lieu thereof to mount the wheels upon separate short stubs, journaled on adjacent independent vertical pivots.

This possesses a marked advantage in that the wheel base constantly remains the full width forward, even when making a short turn. Another advantage lies in the fact that the wheels, being journaled adjacent to their pivots, are not easily deflected upon encountering obstacles and inequalities in the road.

This idea is not new. The earliest patent thereon was granted in England to Rudolph Ackermann, Jan. 27, 1818, and numbered 4212.

It is strange to find such an early patent carried to such a fine point of development. Ackermann shows two points, which are universally conceded to be of great use if not absolutely essential to produce a successful motor vehicle to-day. These are the short stubs with independent pivots for the front wheels, and the turning of the wheels at different angles in steering, so that they will make circles around a common center. In addition to these, the germ of another invention is shown.

By this I mean the idea of mounting the pivots of the stubs in a line, which, if extended, would intersect the tires at the ground. Ackermann does not show the complete idea, but the inception seems to be there. The drawings show a tendency that way; the specification is silent.

What invention there is in the modern steering devices is shown in this patent, and in the patents of Clarke and Motley and of Lee and Saplin, descriptions of which will follow. If the inventions shown in these three patents be combined in an obvious manner, then the most modern type of steering device will result.

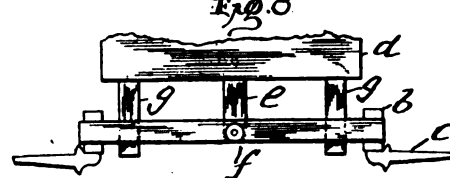
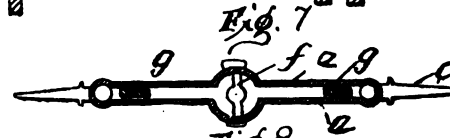
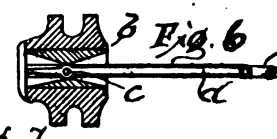
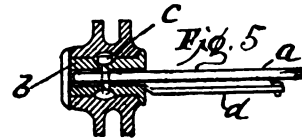
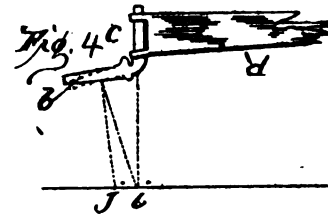
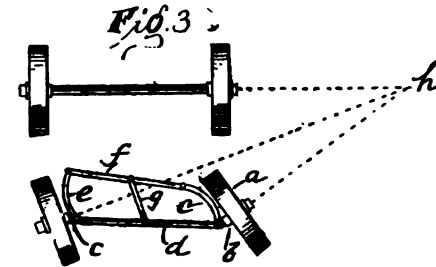
I consider these three patents of great importance, and will therefore describe them in some detail.

Fig. 3 is a view of one part of Ackermann's invention.

Referring to the figure, the front wheels *a a* are mounted on the stubs *b b*, which are in turn pivoted at *c c* to the extremities of the fixed axle *d*.

The controlling arms *e e* are connected together by the bar *f*, which is manipulated by means of the lever *g*. The latter is handled in any desired manner. If the bar *f* be a few inches shorter than the distance which separates the axes *c c*, it will cause the wheel on the side toward which the carriage is intended to turn, to describe a circle of a greater degree of obliquity than the opposite wheel. If the relative length of the bar *f*, and axle *d*, be correctly apportioned, the several radii of all the wheels will center at a common point, as at *h*. This will be conducive of quick and easy turning, as will be evident.

Almost the identical construction is shown in the American patent to L. D. Hurd, of May 26, 1885, No. 318906. In this patent, however, the controlling arms extend forward or away from the rear axle, and consequently the connecting bar is slightly longer than the separating space between the two pivots.



A different way of concentrating the centers of the radii of the several wheel circles is shown in the French patent to Bollée, of April 28, 1873, No. 99574, in which cams and belts are used instead of levers and connecting rods. The wheel studs carry pulleys; the lower extremity of the steering pillar carries two cams, oppositely arranged. Belts connect the cams to their corresponding pulleys. The cams are so arranged that their eccentricity increases out and toward the outside wheel, and decreases toward the inside wheel. This will have the effect of turning the inside wheel at a somewhat sharper angle to the original path of travel.

Another important part of Ackermann's invention is shown in Fig. 4. It will be seen that the stub *b* does not form a right angle to the vertical pivot *c*, but, on the contrary, makes an obtuse angle thereto.

As shown in the figure, the line forming the continuation of the pivot strikes the ground a short distance inside of the bearing point of the tire, at *j*.

If the wheel should be inclined to a greater angle, so as to cause the imaginary line to intersect the tire at the ground, at *i*, a very great advantage would accrue. The pivots would be within the line of draft of each wheel, so that the resistance of the wheels, where they strike against obstacles, would be divided equally on both sides of the pivot, causing the wheels to run steadily, and preventing any violent or dangerous movement of the studs and the steering apparatus.

Instead of inclining the wheel, the pivot can be arranged above the same, and be connected to the bearings of the wheel by forks, or the pivot may be arranged within the center of the hub itself.

The first of these forms is shown in the English patent of John Hanson, of Aug. 31, 1830, No. 5991. In this patent the hubs are mounted upon ball and sprocket bearings at the extremities of the axles. They are guided and held in place, however, by forks, which have vertical pivots, attached to the sides of the vehicle.

Another illustration of the idea of mounting the vertical pivot within the hub itself is shown in the English patent to Clarke and Motley, March 14, 1849, No. 12514.

This patent is of some interest. Not only are the steering wheels mounted upon short stubs, but the pivots therefor are arranged within the wheel hubs themselves, and are immediately over those portions of the front tires that are in contact with the ground.

Figs. 5 and 6 show vertical and horizontal sections, respectively, of this device.

This invention consists in using an axle, carrying short stubs at the extremities of which are mounted the steering wheels. The axle does not twist or turn for steering, but is always at right angles to the body of the vehicle. The greatest improvement shown in this patent, however, lies in the fact that the pivots for the stubs are located within the center lines of the wheels, and above the line of draft of each wheel.

a is the axle, which is square throughout; b b are sockets fitted on to each end of the axle. These sockets have a longitudinal slot in the center. The axle passes through the slot, and a pivoting pin passes through the socket and axle. The outside of the socket is cylindrical; and on this the wheel revolves, as on an ordinary axle. d d are two rods, one fitted into each socket, for turning them horizontally on the pins c c, and thus accomplishing the steering.

A line drawn through each of the pins c c would intersect the tire where it comes in contact with the ground.

Another instance of an analogous construction is shown in the French patent to Guidez and Collin, No. 77498, granted Aug. 22, 1867. In this patent the front wheels are mounted upon the ends of short axles or stubs, which are pivoted to the edge of the vehicle body adjacent to the wheels, and extend to a position slightly beyond the center line of the vehicle, where they overlap. Each is provided at its extremity with an internally geared sector, both of which engage with a thick pinion attached to the lower end of the vertical steering pillar. This device seems to be fairly practicable and with slight modifications could be used to-day.

The first instance of independent short stubs in America is shown in the patent to Joseph Pine, No. 7758, of Nov. 5, 1855.

In this patent the inner ends of the short stubs are provided with toothed sectors, which engage respectively upon the opposite sides of a pinion, carried upon the lower extremity of the steering pillar.

Another patent granted to R. C. Plowden, Jan. 16, 1872, No. 122849, shows axles pivoted on the vehicle body in bearings, as in the French patent before mentioned.

An American patent to W. H. Milliken, May 25, 1875, No. 163681, is of interest as showing the stubs mounted upon springs and sliding in boxes attached to the outside of the vehicle body. This patent shows the four wheels as drivers and steerers.

These devices were all lacking in this one respect; they lacked flexibility, and could not be used on rough and uneven roads. By mounting the front axle upon a horizontal pivot the entire device became sufficiently flexible.

The first appearance of this feature is in the English patent to Lee and Saplin, No. 2321, of Sept. 17, 1861. A horizontal section is shown in Fig. 7, a front view in Fig. 8.

Each of the leading or guiding wheels is mounted on pin or short axis c, which itself projects from a vertical axis b; these vertical axes turn in bearings at each end of an axle a, which passes transversely across the engine below the front thereof. The vertical axes have arms connected with them, which, by links, are manipulated and cause the vertical axes, which carry the pins on the guiding wheels, to turn also and will thus set the wheels at an angle to the engine, thus guiding it, when in motion, in any desired direction.

The front axle is formed of two parallel bars supported upon the lower extremity of the projection e by means of a horizontal pivot f. Between the two parallel bars are two stationary fingers g g. These fingers depend from the bottom of the vehicle body d, one on each side, and serve to keep the axle square in relation to the line of march, but yet allow it to oscillate in encountering obstacles upon the road. This produces a very flexible device.

The first instance of the horizontal pivot in America is shown in the patent to George T. Ellis, No. 161217.

But slight improvements have been made subsequently to these enumerated patents. There seems to be but little further need of improvement in steering gears.

By a judicious combination of the devices outlined in the before-mentioned patents, a practical and successful steering gear could no doubt be made; a gear that would serve every purpose and which would not conflict with any live patent.

Proportioning Otto Cycle Gas Engines.

By E. J. Stoddard.

If in the formula for the work in foot-pounds per working stroke,

$$(3) \quad W = 110 A V \left[\sqrt{\frac{V}{V_1}} - 1 \right],$$

we substitute the value of a horse-power and the number of working strokes per minute, taken as half the number of revolutions, we shall have

$$(19) \quad H P = \frac{A V \left[\sqrt{\frac{V}{V_1}} - 1 \right] N}{600}$$

in which HP is the net indicated horse-power; A, the piston area in square inches; V, the volume in feet of cylinder length at the outer dead center; V_1 , the volume in feet of cylinder length at the inner dead center, and N, the number of revolutions per minute.

Inasmuch as

$$\sqrt{\frac{V}{V_1}} = \sqrt{\frac{P_1}{P}}$$

in which P is the absolute pressure at the outer dead center

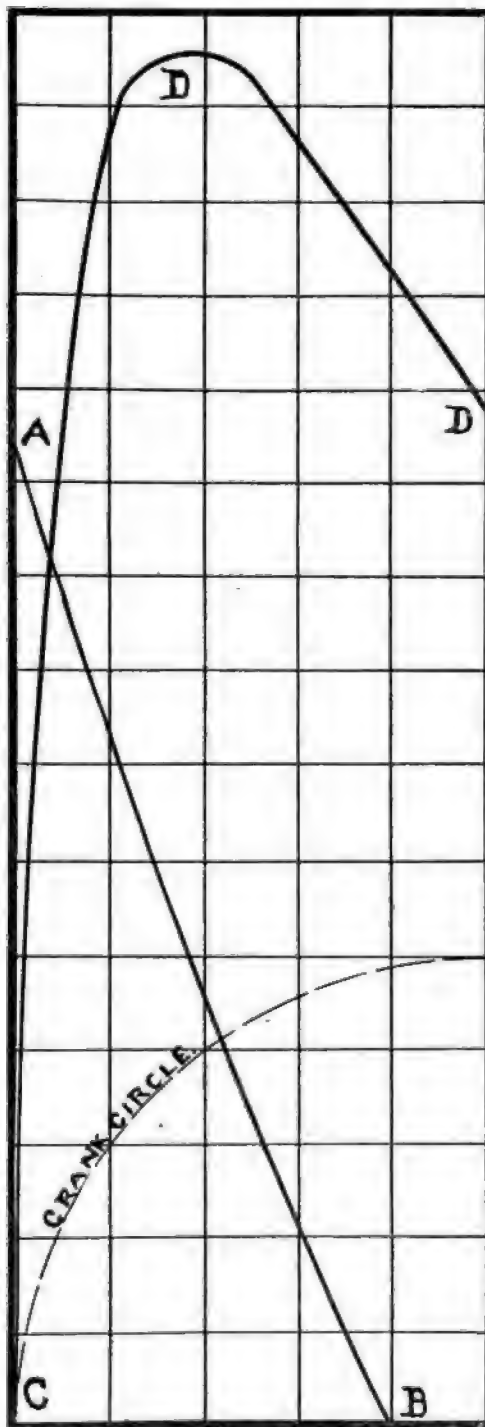


FIG. 1.

P_1 , the pressure due to compression, we may substitute the latter ratio for the former in 19, giving

$$(20) \quad H P = \frac{A V \left[\left(\frac{P_1}{P} \right)^{\frac{1}{\gamma}} - 1 \right] N}{600}$$

SPEED OF ENGINE.

In designing an engine, we would first decide at what speed we are to run it. On the one hand, we do not want to run it too slow, because then it would have to be too bulky in

order to get the required power; on the other hand, we do not want excessive vibration from the inertia of the reciprocating parts.

Personally, the writer believes that the vibration from vehicle motors is due more to the moment accelerating the fly wheel than to the inertia of the reciprocating parts.

If this is so it would seem to be another reason why an engine to drive a vehicle should have a high speed of rotation.

For example, let us take an engine of 5-in. stroke, 4-in. diameter of cylinder, weight of reciprocating parts 10 lbs.,

revolutions per minute 400, ratio of volumes, $\frac{V}{V_1} = \frac{1}{4}$.

In Fig. 1 the line A B is a diagram of the forces due to the inertia of the reciprocating parts for the first half of the stroke and the line C D is a diagram to the same scale of the forces due to the moment accelerating the fly wheel reduced to a 2-ft. radius.

It will be noticed that these two classes of forces act at right angles to each other.

The load against the engine has not been taken into account in drawing the line C D, so that that may be taken as representing maximum values.

The usual formula for estimating the force due to the inertia of the reciprocating parts is

$$F = .00017 W S N^2$$

in which W is the weight of the reciprocating parts, S is the stroke and N is the number of revolutions per minute.

The maximum moment, in statical foot-pounds, accelerating the fly wheel, may be approximated by the following equation:

$$(21) \quad M = 20 A D \frac{V}{V_1 + \frac{1}{4}} \sqrt{\frac{V}{V_1 + \frac{1}{4}}}$$

It is thought that the vibration due to a gas engine for vehicles presents some new phases that will repay careful consideration. The subject is merely touched upon here.

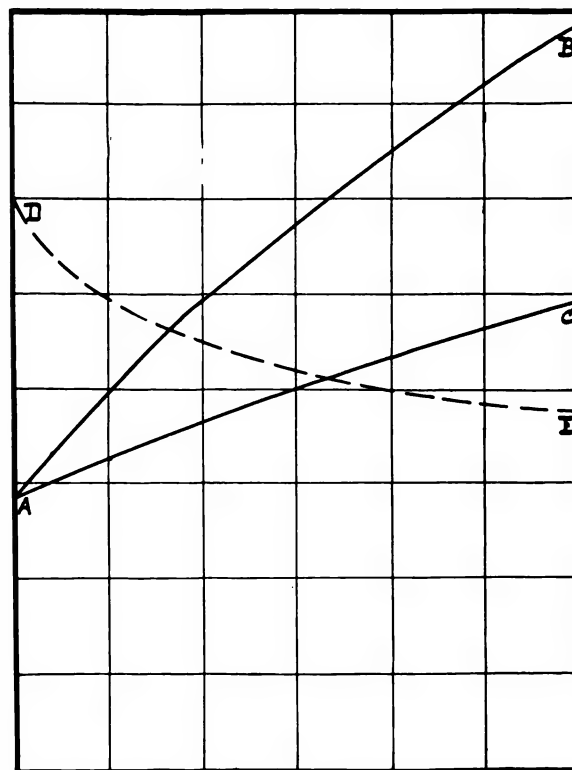


FIG. 2.

AMOUNT OF COMPRESSION.

With high compression an engine is less bulky and more efficient; on the other hand, as the compression increases, the liability to leakage and back explosions also increases. Besides, the vibration due to the second cause above spoken of increases with the compression.

In Fig. 2 horizontal distances represent ratios of volumes, $\frac{V}{V_1}$ and vertical distances foot-pounds per stroke.

The line A B represents the relative power per stroke, the compression being increased, while the volume V at the outer dead center remains constant. Of course the stroke varies. The line A C represents the relative power per stroke, the compression being increased, the length of the stroke remaining the same. In this latter case the relative volumes at the outer dead center are represented by the ordinates of the broken line D E.

In practice the amount of compression varies from 20 to 100 lbs. per square inch.

AN EXAMPLE.

We wish to construct an Otto cycle gas engine of 5 i.h.p. [$5 \times .80 = 4$ h.p. brake].

We shall run it at 500 revolutions per minute, compress to 70 lbs. gauge (84.7 absolute), and shall have a 5-in. stroke.

Substituting values in

$$(17) \quad V = \frac{S}{1 - \frac{P}{P_1} \sqrt[4]{\frac{P_1}{P}}} \quad \text{we have}$$

$$V = \frac{5}{1 - \frac{1}{5.762} \sqrt[4]{\frac{1}{5.762}}} = \frac{5}{1 - \frac{1}{5.762} \times 1.55} = \frac{5}{\frac{4.212}{5.762}} = 6.84$$

inches of cylinder length, or .57 ft. of cylinder length.

Substituting values in 20,

$$5 = \frac{A \cdot .57 \cdot (.55) 500}{600}$$

$$156.75 A = 3,000$$

$$A = 19.14$$

This corresponds to about 4 15-16 in. diameter of piston.

If we have not made up our minds as to just what stroke we shall have, we may substitute the ratios of pressures in equation 20, thus:

$$5 = \frac{1}{4} A V [.55]$$

$$5 = .46 A V$$

$$A V = 10.9 \propto$$

As we have the value of the product of the area by the volume at the outer dead center, either factor may be selected arbitrarily, and the corresponding value of the other factor calculated by simply dividing both terms of the equation by the value selected.

SIZE OF CONNECTING ROD.

If we take a factor of safety of 16 after a series of substitutions and reductions, we get the following expression for the maximum diameter of a connecting rod having a circular cross-section,

$$(22) \quad d = .081 \sqrt[4]{L} \sqrt[4]{D} \sqrt[4]{\frac{V}{V_1}}$$

in which L is the length of the connecting rod in inches and D is the diameter of the piston in inches and fractions thereof.

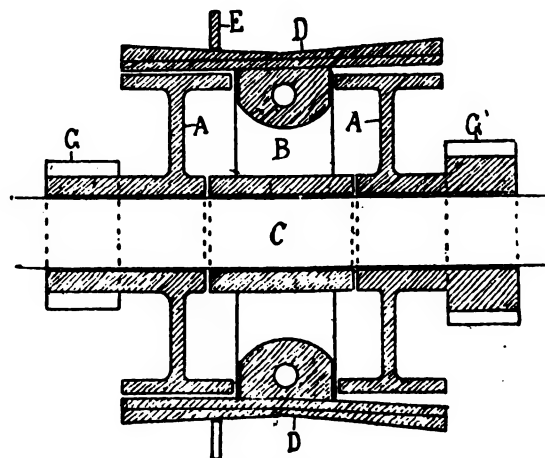
If a rectangular cross section is preferred, it may be taken with a maximum height of 2.7 times its breadth, and its breadth may be taken as .4844 of the diameter of a rod having a circular cross-section,

$$B = .4844 d$$

OUR FOREIGN EXCHANGES.

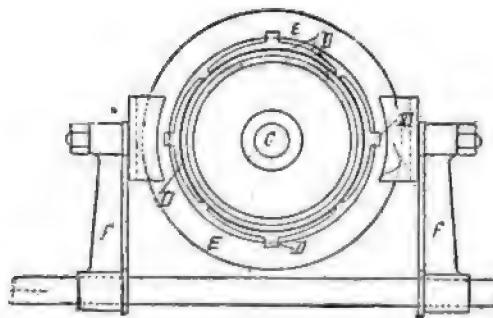
The Greffe Friction Clutch.

Although the use of friction clutches in engineering work is by no means a new departure, says the Motor Car Journal, yet the revival of the horseless carriage movement would appear, judging from the large number of new devices which have lately come under our notice, to have given an impetus to the devising of new forms of clutches. Among these we may mention that which has been lately brought out by M. E. P. Greffe, of 34 Rue Philippe de Girard, Paris, of which we are herewith enabled to publish a brief description and several illustrations, Figs. 1, 2 and 3. The illustrations show the



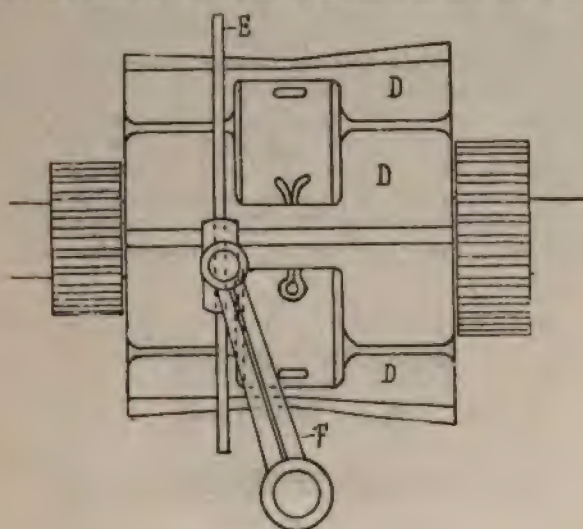
SECTIONAL VIEW.

clutch arranged in such a way on the crank shaft of a motor car as to control by a single lever the putting in and out of gear of two variable speeds, and to disconnect entirely the motor from the power-transmitting mechanism. Referring to Fig. 3, it will be seen that the motor shaft C has keyed on it a



END VIEW.

disk or pulley B, to the periphery of which are attached four shoes D. The shoes project beyond the pulley B on both sides, and are so pivotally mounted on it that one side or the other may under pressure be moved slightly downward, the opposite end of course rising a corresponding distance. At each side of the disk B are two pulleys A A', running loosely on the shaft C; the faces of these pulleys, which are directly under the projecting portions of the brake shoes D, are covered with leather. It will be noticed that the outer faces of each of the shoes D are provided with longitudinal ridges or projections, the upper surfaces of which form two inclined planes. Fixed round the disk B and shoes D is a thin steel ring E, which is free to slide the whole width of the shoes D under the action of the levers F, which terminate in a pair of

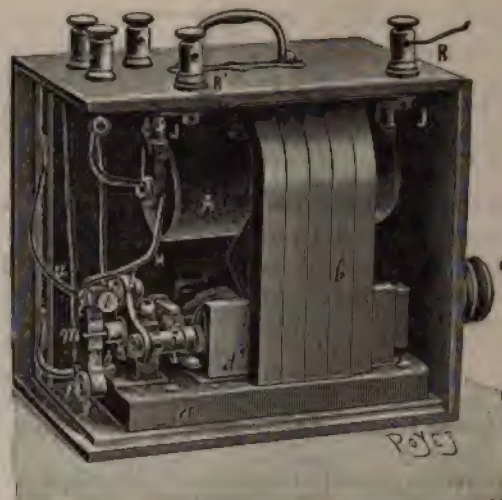


ELEVATION.

forks, between which, but not in contact with the same, is the ring E. When this ring is placed in a central position the disk B, the shoes D, and the ring will all rotate without transmitting any power to the pulleys A A'. By forcing the lever F over to the left the ring E is also carried in the same direction, and meeting the inclined planes of the balanced shoes D the latter are pressed down into contact with the face of the pulley A. Similarly, if it is desired to make connection between the shaft C and the pulley A', the ring is, by means of the lever, forced over to the right, the right-hand end of the shoes D then being brought into frictional contact with the pulley A'. Rigidly connected with the pulleys A A' are two spur wheels G G' of different diameters, which transmit the power at their respective speeds to corresponding spur wheels on an intermediary shaft. M. Greffe, who informs us that very little pressure is required on the lever F to alter the position of the ring, has sent us a diagrammatic circular showing his clutch arranged for use on De Dion motor tri-cycles, Bolée voitures, and for both belt and spur wheel driven motor carriages.

Houpiéd's Magneto Ignition Device for Gasoline Motors.

M. E. Houpiéd, of 16 Rue Royer Collard, Paris, says the Motor Car Journal, has recently brought out a new magnetic ignition device for petroleum spirit motors, which ob-



viates the use of primary or secondary batteries. A view of the apparatus is given herewith, from which it will be seen that it comprises a magneto-electric machine, driven off the motor itself by a small band working on the grooved pulley c. In circuit with the magneto-electric machine is an interrupter, worked by a cam on the shaft of the small generator. Owing to the action of this cam contact is continually being broken, this rupture in the primary circuit to the induction coil giving a regular continuous succession of good sparks in the secondary circuit. Referring to the illustration, b is the permanent magnet and d² the stationary armature within which rotates a soft iron envelope. The two principal organs are the cam m on the end of the generator shaft and the interrupter e, the latter forming part of circuit of the primary current. Each time the cam acts on the interrupter a rupture is caused in the primary circuit between the generator and the induction coil A, carried by the supports J. A feature of this coil is that it has no trembler. The connection between the interrupter and the wire H to the induction coil is made at t by means of a platinum point. From the coil the secondary circuit wires are connected to the terminals R R', from which the wires run to the explosion chamber, where the sparking takes place. The putting in operation of the device is claimed to be very easy, a few turns of the motor fly wheel being all that is necessary. It can also be so arranged as to provide the necessary electric spark for two or more cylinders and the current for a small incandescent lamp. The power required to run the new ignition device is very small, and in view of the certainty of its action and the small space it occupies, we are informed that, although it has only been on the market a short time, it has already met with a large adoption by motor car builders and owners in France. As will be seen, the whole of the device is contained in a dust-proof box.

A Criticism of the De Dion Motor Cycle.

A writer in the English Mechanic thus criticises the De Dion motor cycle:

As regards the patents involved in the machine he says these patent rights are only on two points, viz., the long bolts that hold the cylinder head to the crank case, and the method of

firing by the contact breaker as used by them. Any other part of the engine can be made, used and sold without fear of infringement, as there is no other point that has not been used by previous makers of oil and gas engines. There is no doubt whatever that Messrs. Dion & Bouton have shown how to produce a light motor eminently suited for this purpose, using proportions that a short time before would have been considered altogether too light for safety. However, they take a lot of making, and often, when made, a lot of starting. Having been greatly interested in the industry, I would like to warn the would-be makers over some points that many English imitators seem to forget, and reasons why they are made in this way by French.

Firstly, the French motor has crept up by degrees from what two years ago was known as $\frac{3}{4}$ h.p. to present one, now known as $1\frac{3}{4}$ h.p. The sizes of this latter are: Diameter of cylinder, 2 19132 in. by $2\frac{3}{4}$ in. stroke; fly wheels, $7\frac{7}{8}$ in. diameter by 1 in. square rim, and a solid web. Note the fact 3-16 in. only in the center, thus throwing all the weight into the rim, where it is wanted. This motor is only just sufficiently powerful for moderate hilly country, and for very hilly districts a two-speed gear is absolutely necessary.

This two-speed gear has not had much attention as yet, mainly because it adds to cost of an already complicated machine, which every one wants as simple as possible. The inlet valve on French motor is inverted—an old idea, by the way, used by Daimler and others years ago. The object of this is to keep spring cool, and (most important) to bring valves as far and close in to piston as they can possibly be got (avoided in English made "trikes" so far), thus avoiding a great waste of compression space not directly over piston, which said waste possesses many defects which I cannot go fully into here. Here, by the way, note diameter of inlet valve, which is 1 in., with about 3-32 in. of lift, the diameter of supply pipe being $\frac{5}{8}$ in. Exhaust valve is 1 3-16 in. diameter, with a head of nickel which alone will stand intense heat of exhaust. Now note exhaust pipe is only $\frac{5}{8}$ in. diameter, and where coupled is reduced to a hole barely $\frac{1}{2}$ in., causing great unnecessary heat at this part, though I must admit it seems in no way to cripple running of engine.

The bearings of these engines are made of what in England is known as axle steel—a very mild grade of Bessemer steel, case-hardened in a muffle for about eight hours. No other kind of steel will stand properly but this, and so treated. All French bearings have the most careful and minute arrangements for oil—first, with oil grooves and holes; secondly, by means of a chamber at ends of main bearings, into which oil runs, and on up-stroke of engine, oil is sucked back by the vacuum in case, as there is a small vacuum valve fitted on side of valve box containing the two-to-one gear. Half the English makers have failed to recognize the object and uses of this valve, which has such an important effect also on lubrication. I omitted to state there is of course a return hole drilled from end of recessed chamber back into crank case, at an angle of about 45 deg. Some English makers contented themselves by merely putting a small bent pipe through side of case to bottom level of piston, to allow for displacement of air by piston and leakage past rings, which with close case would tend to slow up motor.

Referring back to fly wheels, one reason of their meaning same is difficulty found in clearing differential gear wheels case. These gear wheels for rapid turning of corners should always be 2 to 1—that is say 10 teeth in pinion and 20 in wheel, and they must be at least two or three times as strong as

small bevel wheels used with ordinary Starley axle tricycle gear, though it is not necessary that this gear be placed in center of axle at all, though it is usual to do so to make all compact to fit into one large case.

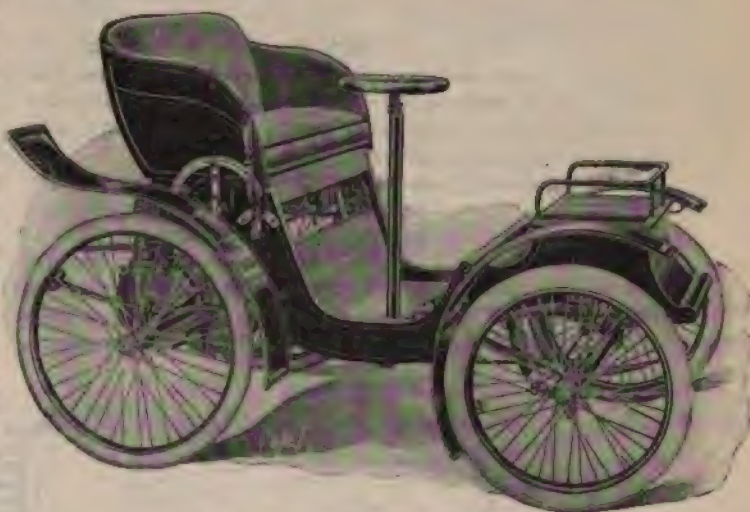
As regards power from the engines and others for which an abnormal power is claimed under best conditions with engine running 2,900 revolutions per minute, I have only been able to make actual power given off 1.125 h.p. In fact, I venture to say that there is not one engine at present advertised on tricycle work that will give the $1\frac{3}{4}$ h.p. claimed for it, however much makers may say to contrary, and I have had considerable opportunities of seeing most of them under a very accurate testing appliance.

With the moving parts of engine—such as piston, connecting rod, etc.—the French properly make these as light as they possibly can. This reduces vibration and tends to smooth running and high speed. The crank cases are always of aluminum for lightness, and for another reason, as this metal can be made much thicker than by using brass or iron. It is found advisable to have it as thick as possible to deaden the sound, which it certainly helps to.

The Automobile Club du Rhin has been organized at Mannheim, Germany.

The Paris Fire Department is introducing motor vehicles to carry the firemen to and from the scene of action.

According to the racing rules just issued by the Automobile Club of France, all race meetings or tests held in France must be licensed by the club, and any one taking part in meetings not so licensed will be disqualified from competing at any licensed meeting.



A NEW VOITURETTE—THE POPULAIRE.

TRADE LITERATURE.

The Autocar Co., of Pittsburg, Pa., are already out with a new catalogue and prospectus, illustrating and describing their new model park trap and runabout. They have purchased land at Swissvale and will erect a factory to be completed Jan. 1. They expect to have 500 machines in the hands of customers by the end of next season.

COMMUNICATIONS.

The Running of the Stanley Carriage.

Washington, D. C., Sept. 16.

Editor Horseless Age:

I note the remarks of Dr. Nottage in your publication of Sept. 13.

An experience of some two months in running the Stanley carriage suggests to me that the consumption of gasoline is more a question of time than of distance. In other words, if you can run the machine 45 miles in three hours with 3 gals. of gasoline, you will use at least 5 gals. if you run the same distance in six hours.

Undoubtedly the ability of Mr. Stanley to run so far with so little gasoline is to a very great extent the result of his familiarity, by a long experience, with the operation of the machine, and the average high speed which he keeps up.

I have found that one of the greatest obstructions to the good average speed is the necessity of slowing up or even stopping where horses are likely to be frightened. In the state of Massachusetts, where I ran the carriage this summer, there seems to be no law or regulation which requires owners to have their horses tied, and in many instances they are left untethered at the side of roads with no one in the vehicle. I fully agree with Dr. Nottage's commendation of the vehicle.

Yours truly,

CHARLES E. FOSTER.

A Balanced Motor.

Philadelphia, Sept. 8.

Editor Horseless Age:

Being in need some time ago of a light weight four-cycle gasoline motor, that was simple in construction and that would run at high or low speed with but little vibration, I examined all that came to my notice, and tried many, none of which met satisfactorily my requirements.

Studying carefully the subject of balanced motors, I began a series of experiments, producing finally the motor shown in Fig. 1, and on which patents have been applied for, both in the United States and abroad. This motor met my demands and runs smoothly and with scarcely any vibration whatever either at high or low speeds. It will be noticed it is a two-cylinder, four-cycle motor, the cylinders being placed opposite,

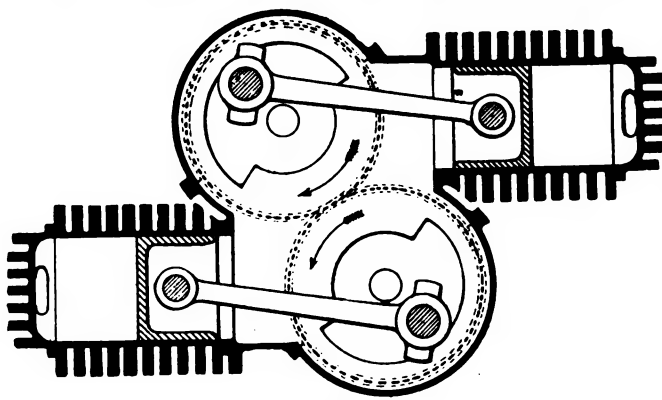


FIG. 1.

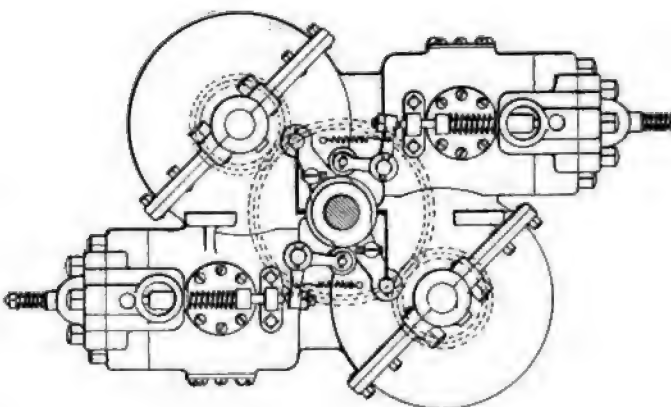


FIG. 2.

one above and parallel to the other. The pistons are connected to separate crankshafts, which are geared to each other so that the reciprocating and revolving parts move always in opposite directions, and at equal velocities, thus balancing each other. The explosions taking place simultaneously in the two cylinders, their force is opposite and balanced. The exhaust valves of both cylinders and the electric igniters are operated from one reducing motion driven from the upper shaft, and the power is taken from either shaft.

Fig. 2 is a modification of the motor shown in Fig. 1. In this motor a shaft is placed between the crankshafts to which it is geared, so that it makes one-half the number of revolutions of the crankshafts. On this shaft, from which the power is taken, is placed the cam operating the exhaust valves of both cylinders, and the electric igniters, which are so constructed that the explosion may be timed to take place at any part of the stroke. The exhaust valves of both cylinders are operated by separate sets of mechanism, and the cylinders are cooled by water jackets.

ERNEST M. WHITE.

Mr. Graham's Definition of Air.

St. Louis, Mo., Sept. 12.

Editor Horseless Age:

I have just read in your issue of Aug. 30 Mr. J. Hector Graham's views on the subject of springs and air cushions, and I must say that I was considerably shocked at the news he imparts, for it upsets all that I ever learned on that subject. I am curious to know where and how Mr. Graham acquired such positive knowledge of the matter, for it is surely startling to say the least.

He says, "Air is not a cushion; it is a solid body." That air should have arrived at the solid state and the fact not create any commotion is surely passing strange in view of the great feats we all thought had been accomplished when Dewar, Tripler and others had succeeded in bringing it to a liquid state. I had always learned that air, ordinarily, was a gas, and, as such, possessed the common property of all gases, that of elasticity, being compressed by an increase of pressure on it and expanding from a reduction of same—an action identical with that of all cushions and springs intended to diminish shocks in moving bodies.

Mr. Graham states also that "air can never be used as a spring, because it is not an absorber." Absorber of what? If

he means shocks, he is greatly mistaken, because air can be an absorber of shocks. What is the object of pneumatic tires on bicycles if not for that purpose?

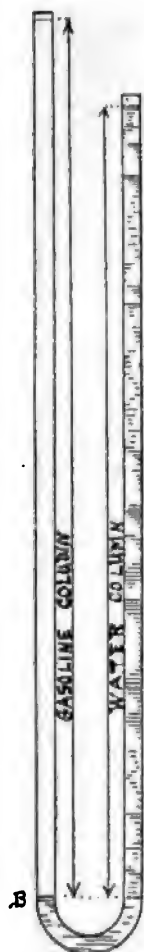
Again, Mr. Graham regrets exceedingly the apparent misunderstanding on the part of others of the "unfortunate" word resilient. He quotes Webster's definition, "Inclined to leap or spring back, rebounding," and thinks very decidedly that this is not what is wanted in a device to ease the shocks of the wheels rising and falling. If Mr. Graham were not so positive on these points, and would think a little, he would see that, in fact, such resilience is just what is wanted.

And "Air and rubber are absolutely incapable of making any moving vehicle running upon an uneven plane ride free from vibration." This is true, but, I believe, not in the sense Mr. Graham intended. It is also, however, equally true of any "combination of steel springs" Mr. Graham might devise. Neither these, air cushions, rubber, nor any other device yet invented, will render a moving vehicle entirely free from vibrations—their object is to reduce them.

My consideration for the "novice" who might have seen Mr. Graham's article led me to write the above, for such knowledge to him (the novice) might, perhaps, be exceedingly dangerous, while to Mr. Graham, if he continues as positive about it, it will certainly be "a delusion and a snare."

Yours truly,

G. E. U.



To Ascertain the Specific Gravity of Gasoline.

Detroit, Mich.,
Sept. 10.

Editor Horseless Age:

I noticed an inquiry in your columns as to how to ascertain the specific gravity of gasoline.

I inclose a sketch of a kind of apparatus that I have used for this purpose. It consists of a glass tube having two vertical legs communicating at the bottom. It is first partly filled with water and then the gasoline is poured into the longer leg until the water is forced down nearly to the bend, as indicated at B.

The height of the column of water divided by the height of the column of gasoline is the specific gravity of the gasoline.

This device was originally described in the National Engineer.

The longer the legs of the tube the more accurate will be the device. Of course, it may be made mostly of metal, inasmuch as one only wants to observe the surfaces of the fluids and the dividing line at B.

In my device one leg of the tube is within the other.

E. J. STODDARD.

The Difference Between a Wire and a Wooden Spoke.

Hyde Park, Mass., Sept. 14.

Editor Horseless Age:

Regarding the comparative merits of wire wheels and wooden ones for motor carriages, I think you are in the main right in your remarks.

Mr. McCue is also correct in his claims for the superior symmetry of the tension wheel. But it is not a question of which is easiest to wash or which runs truest when made. There is a stubborn principle involved which has to be met and reckoned with, viz: A wire stretched under tension has no flexibility or elasticity, but a wooden spoke under a compressive strain has.

Yours truly,

W. C. BRAMWELL.

QUESTIONS AND ANSWERS.

At the request of many of our readers we have decided to open a department of questions and answers. We will endeavor to answer any detail question in practical engineering pertaining to motor vehicles.

Some Puzzlers.

Newark, N. J., Sept. 5.

1. When power is brought to the center of a vehicle wheel will the tendency not be centrifugal?
2. When power is brought to the periphery of a vehicle wheel will the tendency not be centripetal?
3. In propelling, is there not forward moving of the wheel's center (axle) the desideratum?
4. How can the wheel's center be profitably moved forward with centrifugal tendency?
5. Does, in these days of steam and electricity, tendency not matter at all?

INQUISITIVE.

The questions are not sufficiently clear to positively determine their object. If a ball be whirled around in a circle, with the aid of a foot or two of string, there is a "tendency" for the ball to fly off into space and a "tendency" for the string to retain the ball in its circular path. The "centrifugal" is just as much in evidence as the "centripetal."

If the purpose of these questions is purely to ascertain whether it is best to apply the turning force to the center of the wheel or the circumference, then it may be suggested that the design of wheel would be the most important factor in determining the character of transmission arrangements.

R. I. C.

Advantages of Wire-Wound Boilers, Etc.

New York, Sept. 6.

Editor Horseless Age:

Kindly answer the following questions:

What advantage over the ordinary steel boiler has the Stanley copper steel-wire wound boiler?

In an article written by Hudson Maxim, appearing in your pamphlet, No. 1, Vol. 1, April 7, 1899, Mr. Maxim suggests a method of condensing the exhaust steam of a steam engine on a motor carriage. Would you kindly diagram his method? I could not quite follow it, i. e., I do not understand how the condensed steam, after becoming water, is forced in the boiler.

Yours truly,

A. B. L.

Answer: 1. The strength of a boiler is the strength of its weakest part, and the weakest part of a shell boiler is in its riveted seams. The Stanley boiler is without longitudinal riveted seams and the winding backs up the soft copper with material of high tensile strength. The writer does not recall any other boiler other than that applied to the Stanley wagon which is wire wound; the principle is, however, familiar as having been applied to guns, fly wheels and steam pipes. Both the British and Italian naval authorities have their copper pipes over 8 in. diameter wound with wire, and the merchant marine is following suit. Time alone is the best test as to the advantages of one make of boiler over another, and the question of superiority is emphatically a matter for the consideration of the purchaser, as well as a matter of workmanship.

2. Mr. Maxim most probably had in mind the condensation of the exhaust steam by bringing it into contact with a large body of water and its uniting therewith, the water being subsequently pumped back into the boiler to begin anew the cycle of operations.

A Knotty Problem in Steering Fork Angles.

Pittsburg, Pa., Sept. 16.

Editor Horseless Age:

We were very much interested in the valuable article by Mr. H. E. Dey upon the subject of "Steering Fork Angles," which appeared in the Aug. 2 issue of The Horseless Age.

Articles such as this cannot help but prove of much assistance to manufacturers of automobiles, and we have already had occasion to use the tables which Mr. Dey compiled, and upon which he deserves congratulations.

As Mr. Dey states, however, the formulas apply only to the simplest conditions, and the four arms must be of the same length. It may, of course, be advisable for manufacturers to depart from these conditions and to employ an arrangement that is more complex, as far as the determination of the fork angles is concerned. A problem that has recently confronted us, for instance, is to find the proper fork angles under the following conditions. The wheel base is 54 in.; the distance between pivots 42 in.; the axle arms are $5\frac{1}{2}$ in., and the fork arms 4 in. long. The fork pivot also is central between the axle arms, but is located $1\frac{1}{2}$ in. away from the axle; that is, this fork pivot is $1\frac{1}{2}$ in. inside of a line drawn between the center of the two axle pivots.

Can a problem of this nature be solved by any formulas which can be deduced to fit the given conditions, or is it a case of "cut and try"? Any information which you can give us upon this subject will be much appreciated by

Yours very truly,

PITTSBURG MOTOR VEHICLE CO.,
Per Norman McClintock.

Proportions of Gas and Gasoline Engines.

New York City, Sept. 1.

Editor Horseless Age:

Please be kind enough to publish in your next issue the dimensions of cylinders, piston stroke, diameter valves and lift of exhaust valves for a 3 h.p., high speed, two-cylinder, four-cycle gasoline engine.

Also please describe a simple vaporizer and the important points of a mixing valve.

Can you recommend a book on dimensions, etc., of gas and gasoline engines?
R. N.

Answer: 1. Would suggest cylinders $3\frac{1}{2} \times 3\frac{1}{2}$. Exhaust valves $1\frac{1}{4}$ in. diameter and 7-16 lift of valve.

2. A simple vaporizer could be formed of a perforated strip of metal wound into a spiral. Cover each side of strip with flannel and insert into a metal case with tight joints and cover, so that air can pass freely between the strips of flannel, which draw up by capillary attraction the gasoline in which their lower edges dip. If passage is too narrow, the air will be too heavily charged and an annoying residue forms in cylinder. A pump should be connected to keep the vaporizer charged with gasoline of an even density as far as this is possible.

The purpose of the mixing valve is to secure a more thorough commingling of the charge by drawing the air and vapor through suitably shaped passages, giving the charge the mixing treatment of a freely turning fan, a paddle or vane, as may meet the views of the designer, and prevent what is termed stratification.

3. It is doubtful if there is any one book either on gasoline engines or motor vehicles that would satisfy the designer. A letter just to hand from a leading English expert laments the lack of good technical literature on this subject. I refer you to E. J. Stoddard's article on another page of this issue.

What is the Trouble with this Engine?

St. Paul, Minn.

Editor Horseless Age:

I have built a gasoline engine Otto cycle, size of cylinder, $4\frac{1}{2} \times 6$ in. stroke; exhaust pipe, $1\frac{1}{4}$ in.; inlet pipe, $\frac{3}{4}$ in. Engine will run 600 turns per minute for about an hour or two at a time and then gradually slow down and stop. It is also very hard to start. Engine has no power. Would like to know how much power an engine of this size ought to give running at 400 revolutions per minute. Are the exhaust and inlet pipes large enough? Engine has hot tube igniter and misses a good many charges. I would very much like to know through your valuable paper where the trouble is with my engine. Yours very truly,

R. A. JONES.

Answer: The dimensions of exhaust and inlet pipes are not any too large for the stated number of revolutions, and at the speed mentioned we should expect about 4 h.p., assuming other conditions favorable. It is no easy task to tell just what the trouble may be, but would suggest that when the engine slows down and stops the exhaust valve should be lifted from its seat and the engine turned by hand. If the engine turns over hard the piston rings are too tight, due to the high temperature. If this is the trouble the rings may be reduced with advantage. Put the exhaust valve down in place and turn the fly wheel; the air in the cylinder should compress, and if the fly wheel is held in one position the pressure should remain constant for some little time, indicative of good condition of valves and seats, as well as cylinder rings. The compression space may be too small. In any event, if the cam will permit, vary the time of exhaust valve opening. See that all valves are carefully ground in; that seats are not cut; that the stems are straight; that the springs will not bind; that cams lift valves at least equal to one-third of diameter of opening, and gas openings are not liable to clog. A weak charge is very probably the trouble, judging from the description.

MINOR MENTION.

An automobile factory is talked of for North Paterson, N. J.

In Indianapolis, Ind., motor vehicles pay a license fee of \$3 a year.

A strong syndicate is about to bring out a new rubber tire for automobiles.

J. C. Wood, a bicycle repairer, of Worcester, Mass., is building three motor vehicles.

Mr. Cunningham, of the Media (Pa.) Carriage Works, has nearly completed his motor carriage.

The Mason Regulator Co., Boston, Mass., are working on an order for 6000 engines for the Locomobile Co. of America.

C. D. P. Gibson has taken his carbonic acid carriage to Rome, N. Y., and is experimenting with compressed air at that place.

A new motor vehicle company is said to be forming to manufacture a three-wheeler under the patents of J. W. Walters, of New York.

F. F. Stanley, of the Stanley Mfg. Co., Lawrence, Mass., builders of the Whitney steam carriage, has joined Mr. Whitney in Europe.

The H. T. Hearsey Vehicle Co. has been incorporated at Indianapolis, Ind., with \$20,000 capital to deal in automobiles and other vehicles.

The Chas. Abresch Co., of Milwaukee, Wis., are among the organizers of the new \$5,000,000 automobile manufacturing company at that place.

The Dow dry battery, made by the Dow Portable Electric Assistant Co., 218 Tremont St., Boston, Mass., is highly recommended for sparking gasoline engines.

The National Motor Carriage Co., of New York, are contemplating the purchase of the Oneida Carriage Co.'s factory, Oneida, N. Y., for a motor carriage plant.

The Twentieth Century Automobile Co. has been formed at Cleveland, O., to compete with the trolleys, lately tied up by a strike, and still suffering from its effects.

New London is to have an automobile delivery service. The new company which is to furnish it is called the New London Messenger and Automobile Parcel Delivery Co.

The directors of the Lewis Motor Vehicle Co., Philadelphia, Pa., are Harry H. Simpkins, Lewis Piott, Daniel Clarke and John W. Graham, of Philadelphia, and Harry C. Chapman, of Baltimore, Md.

W. P. Kidder, Jamaica Plain, Mass., well known as the inventor of the Wellington and Franklin typewriters, is constructing a steam carriage embodying a number of improvements in the boiler.

The Illinois Electric Vehicle Co., Chicago, Ill., have purchased property at 171 to 175 Michigan Ave. and will erect a cab station upon it. The price was \$200,000, \$50,000 down and \$150,000 in five years or less.

The Peoria Rubber & Mfg. Co., Peoria, Ill., are pushing the motor gun carriage which they are making for Major Davidson in the hope that the Major may reach New York with it in time for the Dewey celebration.

The Henderson Horseless Carriage Co. is said to be about to establish a factory at Los Angeles, Cal., for the manufacture of three-wheelers, invented by Chas. E. Duryea, of the Duryea Mfg. Co., Peoria, Ill.

At the meeting of the Fairmount Park Commissioners, Philadelphia, on Sept. 8, when it was expected favorable action would be taken in regard to automobiles, no quorum was present, and the matter was laid over.

The Automobile Co., of Los Angeles, Cal., filed articles of incorporation recently with a capital stock of \$50,000. The directors are Isidore B. Dockweiler, Clinton Johnson, Henry E. Carter, R. D. Morris and D. H. Laubersheimer.

The People's Passenger Transportation Co. has been incorporated at Springfield, Ill., with \$5,000 capital, to run gasoline stages in Chicago. Frederick H. Vercoe, Morris D. Mason and James H. Hazzard are the incorporators.

E. S. Kelly, formerly president and manager of the Rubber Tire Wheel Co., Springfield, O., is about to start a motor vehicle factory there, a machine being now in course of construction at the factory of the Grant Wheel & Axle Co.

Charles L. Fair, the San Francisco millionaire, is having a three-seated gasoline carriage built by local craftsmen, among whom are the Oriental Gas Engine Works, the Union Machine Co., the California Gas Engine Co., J. M. Ough and Geo. Wallenbaugh.

The New York Electric Vehicle Transportation Co. has decided to adopt three styles of uniform for its motormen, one to be used in the cab service, one for the automobiles rented by the month or season, and the third for the coupes, coaches and victorias.

The Consolidated Rubber Tire Co., 100 Broadway, N. Y., has declared a quarterly dividend of 1¼ per cent. on its preferred stock. The purchase of the solid rubber tire business of the Goodyear Tire & Rubber Co., of Akron, O., is announced.

Amesbury, Mass., the carriage-making center of the East, has a new \$150,000 automobile manufacturing company, under the management of Joseph T. Clarkson, Charles F. Worthen and Edward B. Brungs, well-known carriage builders. Electricity will be the motive power.

The Ball Bearing Co., Boston, Mass., are working a night shift, and have orders enough ahead to keep them busy until next spring. The department of motor vehicle bearings is particularly busy. J. J. Quigley, for many years in the company's employ, has been elected secretary.

A large manufacturing concern in New England has contracted to enter largely into the manufacture of Altham stationary gasoline motors, and another very large concern of that section will build Altham motor vehicles. A new model carriage will be completed about Oct. 1.

A new company has just been formed at San Francisco, Cal., to manufacture a gasoline carriage invented by J. M. Wilkins,

proprietor of the Cliff House, near that city. The capital is \$100,000, and the incorporators are J. M. Wilkins, A. Wilkins, W. Newman, A. Fahrman and R. Jordan, all of San Francisco.

The Stanley Brothers are no longer acting as managers for The Locomobile Co. of America, but are rusticated in the Maine woods. The Locomobile Co. are increasing their force of employees at both factories, and expect to be delivering 10 carriages a day by October 1st. They now recommend 2 1-2 inch tires for country roads.

The Strathmore Automobile Co. has been incorporated under Maine laws with \$1,000,000 capital. The incorporators are Augustus H. Patterson, of Peabody, Mass.; Garret D. W. Clark, Salem, Mass., and Joseph O. Banning, Boston, Mass. The company's office is in the Albion Bldg., Boston, Mass. Steam vehicles will be manufactured.

The new model Grout carriage will be ready to exhibit about Oct. 1. It will show a number of original features, including a double braced frame, spring-suspended mechanism, novel compensating gear and devices for equalizing the strain of the road. Their new factory, specially constructed for the manufacture of motor vehicles, and which will accommodate 200

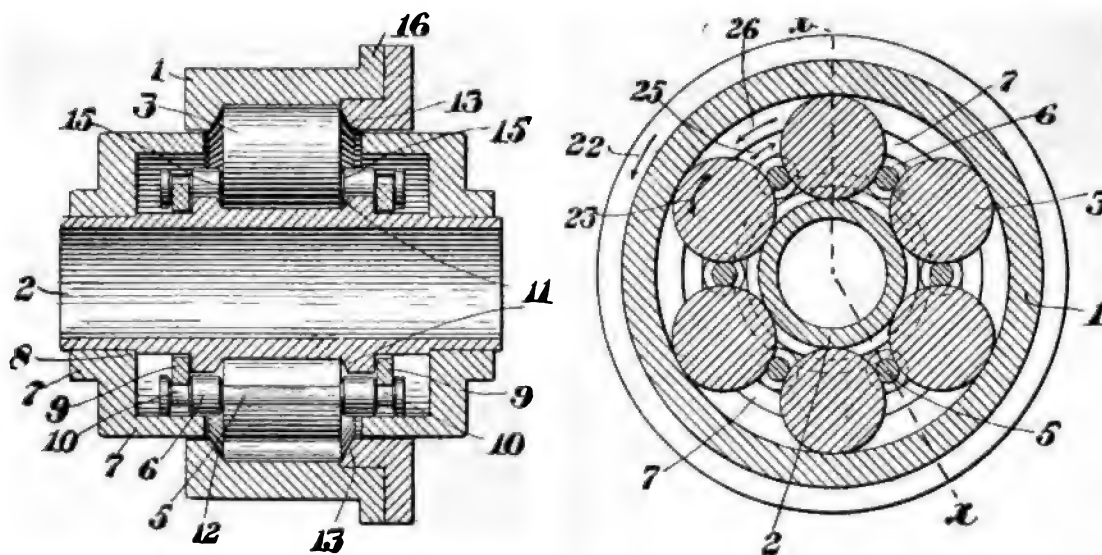
The A. R. B. Roller Bearing.

A new roller bearing, the "A. R. B.," is being placed on the market by the American Roller Bearing Co., 27 State St., Boston, Mass.

The company was but recently incorporated under New Jersey laws with \$1,000,000 capital, although the bearings have been under exhaustive practical tests for a year past in all kinds of service, including the cabs of the Electric Vehicle Co. in New York, and are now being manufactured in all sizes from the bicycle bearing up to those adapted to carry the heaviest loads.

One of the chief claims made for this bearing is that its action is a pure rolling one without the slightest dragging to interfere. The end thrust is taken up on the same principle as in a car wheel running against a rail by rollers running against a bevel. This feature renders lubrication unnecessary except for the prevention of rust.

The bearing consists of a set of main rollers running in races on the hub and axle, separated by intermediate rollers, which prevent the rollers from rubbing against each other and keep them in alignment. Supports are said to be so constructed for the separating rollers as to give a purely rolling action and



THE A. R. B. ROLLER BEARING.

hands, is being fitted out with machinery as rapidly as orders can be filled.

A company has been organized at Portland, Me., to do a general transportation business in that city and through the State. The capital of the new corporation will be \$100,000, and the officers are Charles W. Gray, Jackson, N. H., president; Edward Preble, Boston, Mass., secretary and manager; Edward M. Rand, Portland, clerk, and George P. Thomas, Portland, treasurer. All three motive powers will be used, electricity being spoken of as the power to be employed for cabs in the City of Portland. The company has an exclusive franchise.

prevent the guiding separators from wearing away, as they often do in the cages used to contain the rollers, and against which the rollers rub.

The separators travel just fast enough around the axle to keep up with the main rollers.

All parts of the bearing are of hardened steel ground accurately to size, reducing the wear so much that it is claimed to be practically negligible. So sensitive is this bearing that an 80-lb. cab wheel fitted with it has been set in motion by resting a quarter-ounce weight on one of the spokes. When the large rolling surface is considered this indicates a very low coefficient of friction and small loss of power.

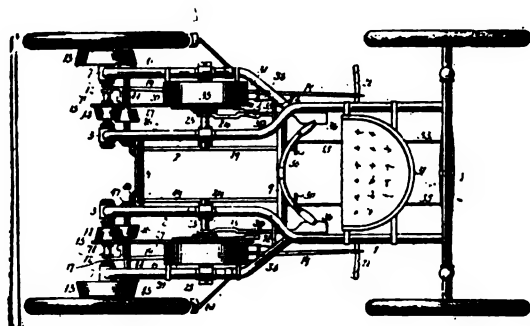
MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 633032—Motor Vehicle.—Charles E. Newman, Baltimore, Md., Assignor to William Colton and Charles G. Hill, same place. Filed Sept. 16, 1898. Serial No. 691076. (No model.)

Claim.—In a vehicle of the class described and in combination with propelling mechanism including a drive wheel shaft and a spring-propelled shaft, of a drive connection for said shafts consisting of the power springs, a sprocket wheel fixed on the spring-propelled shaft, a sprocket wheel loose on the drive shaft and a chain connecting said sprocket wheels and a



clutch for said loose sprocket wheel, means for putting the springs under tension and means for locking said springs consisting of the clutch lever having a stop arm, the ratchet gear 34 fixed on the spring-propelled shaft and the treadle lever having the pawl 38 for engaging said ratchet gear.

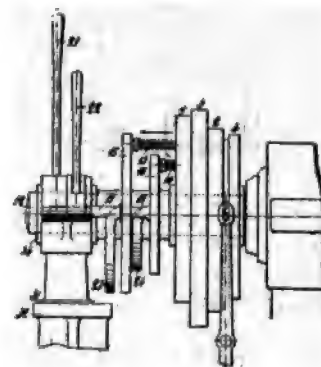
No. 632913—Gas Engine.—Franz Burger, Fort Wayne, Ind., Assignor of three-fourths to Henry M. Williams, same place. Filed June 18, 1897. Serial No. 641350. (No model.)

No. 632743—Reversing Gear for Gas or Petroleum Engines.—Etienne Petréano, Paris, France. Filed Nov. 8, 1897. Serial No. 657879. (No model.)

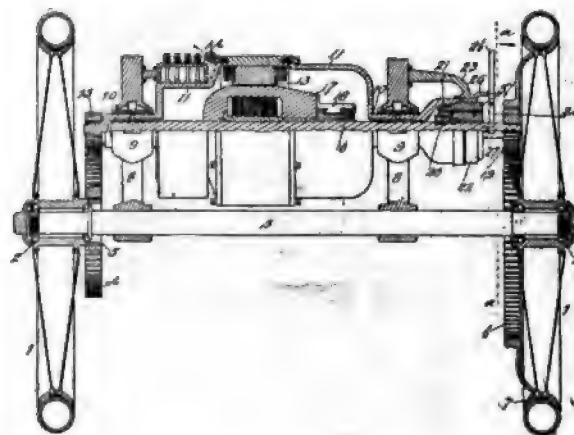
Claim.—In an explosion engine, the combination of the admission cam and the exhaust cam, loosely mounted on a shaft adjacent to a disk fixed on said shaft, said cams and disk being provided with two series of perforations, one series being brought into registration in one position of the cams and disk, and the other series in another position, and locking pins common to both cams for securing said parts together in either of the two working positions.

No. 632805—Automobile.—William R. C. Corson, Hartford, Conn., Assignor to the Eddy Electric Manufacturing Co., Windsor, Conn. Filed July 3, 1899. Serial No. 722626. (No model.)

Claim.—An automobile having supporting wheels, an electric motor with a field arranged to rotate about the armature and



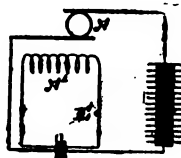
an armature arranged to rotate oppositely, gearing between the field frame and a wheel on one side, gearing between the armature shaft and a wheel on the opposite side, means for supporting the motor, an interior cone on the field frame shaft, an exterior cone on the armature shaft, a wedge formed of two



rings, one within the other, and a yoke with parts engaging the wedge rings and adapted to force them against the conical surfaces that rotate with the field frame shaft and with the armature shaft.

No. 632874—Controlling of Electric Motor Vehicles.—Henry Leitner, London, England, Assignor to the Electrical Undertakings, Limited, same place. Filed Sept. 27, 1898. Serial No. 692021. (No model.)

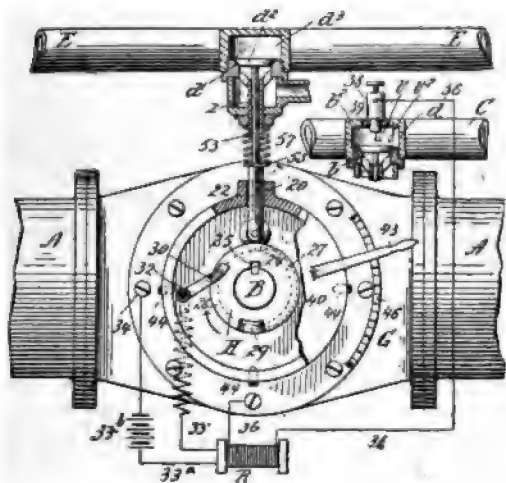
Claim.—In means for controlling electric motor cars, the combination with a main battery in two parts which can be placed in parallel or series, a small battery and a motor, the field magnet of which is excited by the small battery and the armature is supplied with current from the large battery, the main circuit passing also through the small battery or exciter, in opposition to its electromotive force of a controlling apparatus consisting of an insulating base, contact pieces mounted upon the said base, connections between these contact pieces and the batteries and motor, a movable part or lever carrying bridges or brushes connecting the said pieces in pairs so that the parts of the main battery may be placed in parallel or series, and resistances connected to the said bars and in the



circuit of the field magnet allowing the field magnet to be weakened in certain positions of the lever.

No. 632763—Explosive Gas Engine.—Hinsdale Smith, Springfield, Mass. Filed May 17, 1899. Serial No. 717124. (No model.)

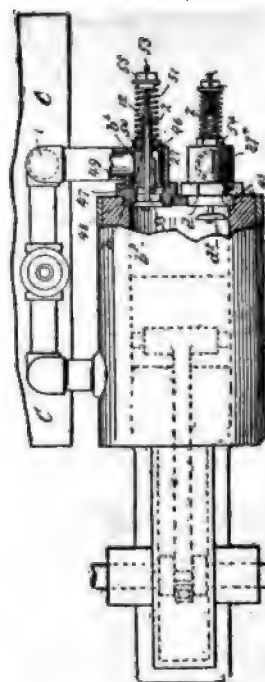
Claim.—In a gas engine of the character described, the combination with the exhaust valve, the shaft B, and the engine body having the outwardly opening cylindrical casing 22, provided with the guiding aperture 20 and within which casing the extremity of said shaft protrudes, the exhaust valve, the exhaust valve stem guided for a reciprocatory movement



through said aperture 20 axially in relation to the shaft, the disk splined and endwise movable on the end portion of the shaft, having the crossing peripheral grooves in which the extremity of the valve stem engages provided with a peripheral cam for imparting an endwise thrust to the valve stem, and having the endwise projection 29, the cap plate 40 rotationally adjustably mounted on and closing the end of said cylindrical casing 22, and having the yielding lever arm 43 engaging said notches 46, spark-producing appliances having a contact member 30 supported on said rotationally adjustable cap plate, and with which said projection 29 coacts.

No. 632762—Gas Engine.—Hinsdale Smith, Springfield, Mass. Filed June 13, 1898. Serial No. 683310. (No model.)

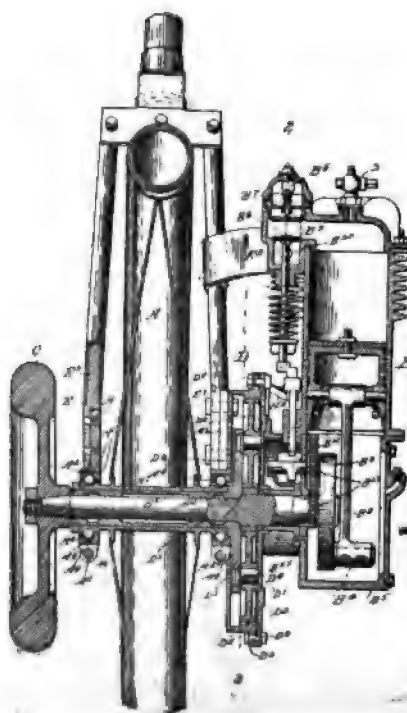
Claim.—In a gas engine, the combination with a cylinder having an opening through its wall, of removable valve devices consisting of an annular bushing piece, screwing into said cylinder opening, and provided with a spider-supported tubular valve stem guide, and having a seat depression 47 in its outer end, and provided at its inner end with a valve seat opening, the valve seated therein having its stem extended through said valve guide and provided with a shoulder 55, and a conduit or connection member having the angularly turned portion with the hole 46 in its back, through which the valve stem and its guide pass, the end portion thereof being entered



in said depression, the nut screwing on the end portion of the valve stem guide against the back of said connection member, and the valve spring 12.

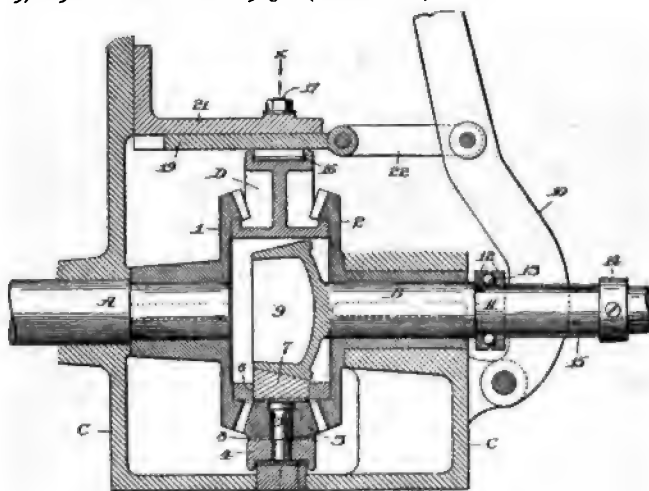
No. 633014—Motor Vehicle.—Henry J. Lawson, London, England. Filed March 28, 1899. Serial No. 710820. (No model.)

Claim.—In a motor driving apparatus, the combination with a driving wheel, of a hollow axle or hub, bearings to support



that hub, a motor mounted at one side of the driving wheel, a motor shaft extending through the hub, bearings on the hub for the motor shaft, a rigid member connecting the motor cylinder with the motor shaft, a fly wheel operatively connected with the motor shaft and concentric with the driving wheel, and at the side thereof opposite to that at which the motor is placed, a central pinion on the motor shaft, a gear wheel pivoted on the hub and geared with the pinion, an annular gear wheel geared also with the said pivoted wheel, and means for controlling the rotation of the annular wheel, for the purpose set.

No. 632886—Gearing.—Viggo V. Torbensen, Westville, N. J., Assignor to George T. Harris, Philadelphia, Pa. Filed Aug. 19, 1898. Serial No. 688983. (No model.)



Claim.—In gearing of the class described, the combination with two shafts, the gears thereon, and the cone on one of said shafts, of a rotatable support intermediate the said gears, pinions journaled to said support and engaged with said gears, clamp blocks intermediate the pinions and the cone, means for actuating the said cone to cause the operation of said blocks and a brake device for said support.

BRITISH PATENTS.

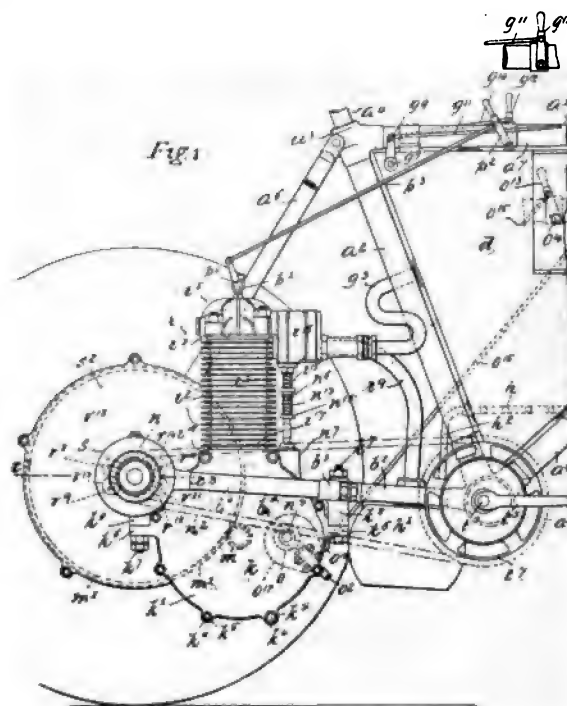
No. 12,980—Improvements in Motors.—Robert Cooke Sayer, Bristol, England. Application filed June 22, 1899.

The object is to use any pressure to actuate wheels or drums by fixing suitable mechanism for their application above and below, and on each side of the center of motion of double levers and therewith give the wheels rotary motion, by the lever acting upon teeth on the wheels, so that one end of the lever acts on one wheel, while the other end is clear of the teeth of the other wheel. Toward the end of the stroke the end of the lever engaged with the teeth is diverted by a guide or other means to clear the teeth of the one wheel, and the other end of the lever is engaged with the teeth of the other wheel.

One, two or more series of teeth are provided, and the levers, with their mechanism, are traversed from one series of teeth to another to act similarly. When greater power is required pairs of the levers act on the teeth of a drum or wheels to act like a drum, so that both ends of one lever engage with the teeth on both sides of the drum, and the ends of the other lever are disengaged from the teeth, the pair of levers is connected by a cross lever or other means, to transmit the power of one lever to the other. One or any number

of such pairs of levers are brought into gear with the teeth of the drum by being traversed in or out of it.

No. 632474—Motor Driven Vehicle.—Charles Thomas Brock Sangster, Bournbrook, England. Application filed March 3, 1899.



This invention relates to tricycles driven by motors, and the chief objects of the invention are to provide a new and improved framing for the tricycle by which it is better adapted to carry the motor and its necessary parts between the supporting wheels, to improve the means by which the tricycle is driven, and to improve the brake mechanism.

AUSTRALIAN PATENTS.

From Phillips, Ormonde & Co., patent and trade mark agents, 533 Collins St., Melbourne, Victoria, the following particulars have been received of motor vehicle patent applications in Australasia. Should any further details be required we are authorized to state that Messrs. Phillips, Ormonde & Co. are in possession of all the information that may be wanted:

No. 11717—Automobile Vehicles.—C. H. Holder, of 103 Queen St., Auckland, New Zealand. June 16, 1899. In the Colony of New Zealand.

No. 16313—Devices for Applying Rubber Tires to Vehicle Wheels.—P. A. Staley, Attorney of the Rubber Tire Wheel Co., of Springfield, in the County of Clark and State of Ohio, U. S. A., Assignee of A. W. Grant, of Springfield, aforesaid. June 30, 1899. In the Colony of Victoria.

No. 16348—Tires for Wheels.—H. A. Stuart, of Akroydon, King's Road, Reading, Berks, England. July 11, 1899. In the Colony of Victoria.

No. 16352—Automatic Vehicle Brakes.—G. G. Turri, of Melbourne, Victoria, Communicated by J. R. Lane, of 1525 Monadnock Building, Chicago, in the State of Illinois, U. S. A. July 13, 1899. In the Colony of Victoria.

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The Columbia Motor and Manufacturing Co. have established their offices in The Pacific Building, Washington, D. C. Any inventors who have good patents on motor vehicles, and wish to dispose of them, will do well to communicate with the Company.

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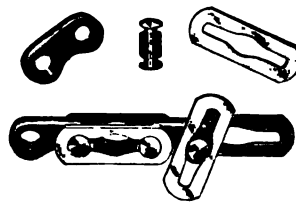
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Robert

VOLUME 4

SEPTEMBER 27, 1899

NUMBER 26

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

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OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,
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STORAGE
BATTERY
NUMBER.

FACTS ABOUT STORAGE BATTERIES.

By Isaiah L. Roberts, p. 9.



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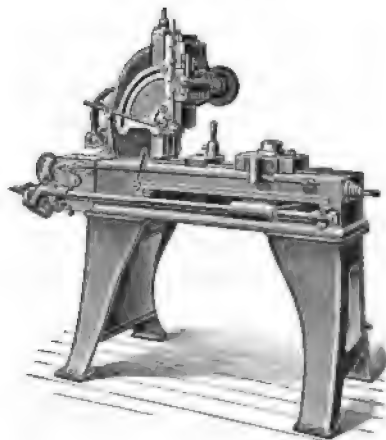
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EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS

VOL. IV.

NEW YORK, SEPTEMBER 27, 1899.

No. 26.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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COMMUNICATIONS.—The Editor will be pleased to receive
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be given as an evidence of good faith, but will not be
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new rule, subscribers are requested to remit by
Post Office or Express money order or N. Y. draft.**

Electric Vehicles and their Limitations.

Electricity is a mysterious force; methods of utilizing it are not mysterious. Inventors may revel in the imagination of its subtle powers, and promoters may draw for the unwary alluring pictures of the wonders it is capable of working in road vehicles. Such fancies are a necessary efflorescence in the formative period of an industrial movement, opening avenues for speculation and research which often lead to more solid achievements. They have their place in the great scheme of nature, and we could not dispel them altogether if we would. But when we undertake to apply any power to commercial conditions, we immediately leave the land of visions and inventions and descend to earth to deal with materials whose properties are known—acted upon by natural laws already partially understood and which may be—nay, must be—further analyzed and implicitly obeyed if practical results are to be attained. This is as true of storage batteries as of any other

appliance that comes from the hand of man, and we have endeavored in this number to present some scientific facts in proof thereof. An electrolytic chemist who has for years made a specialty of storage batteries, explains for us the mechanical and chemical features of the storage cell; a consulting engineer, who has thoroughly investigated all systems of propelling vehicles, gives us his views, and another specialist tells us something about the charging and discharging of storage batteries.

Lead oxides, lead-antimony, sulphuric acid and the electric current passing through and modifying them in various ways according to known laws. This is all there is of it, with the exception of cobble stones, car tracks, ruts, etc., too familiar to American motor inventors. This is a subject for the scientist. We need no magician here.

No modern invention has enlisted so large an expenditure of time and money with so little result as the electric storage battery. Fortunes have been wasted in fruitless efforts to overcome by some mechanical means the inherent weaknesses of the storage cell. The electro-chemical limitations of the battery have been lost sight of, and attention has been centered on superficial devices which are generally worse than useless, and which, if they were perfectly successful, could but slightly change the net result.

The amount of energy which can be derived from the two chief types of cell—the Planté and the Faure—under ideal conditions, can readily be computed. The chemical changes which take place in a cell when it is charged or discharged are accompanied by considerable losses through internal resistance of the molecules of lead to those changes, as well as by heat and by buckling and sulphating, accidents which happen even in stationery work, and the liability to which increases as the service becomes rougher and more exacting. For this reason a cell which gives satisfactory service in stationary work is wholly unfit for vehicle work, where the batteries are called upon for frequent high discharges and are exposed to a vibration most detrimental to the plates. The old Planté or

formed plate has therefore been substituted for the more inefficient and cheaper Faure or pasted plate in vehicle batteries with somewhat better results. But the inventor who undertakes to design a storage battery for a commercial vehicle is still between the devil and the deep sea. If, in the effort to increase efficiency, he loads the lead oxide on to his plate he increases weight without a corresponding gain in efficiency, for as Mr. Roberts shows, only so much of the oxide as comes in good electrical contact with the plate is available for current and the remainder is liable to become detached and short circuit the cell. If he attempts to lighten his battery materially he must discharge at a high rate, lessening efficiency and capacity and incurring the dangers of weakening and buckling. As to the extent of the loss which must necessarily take place during the chemical transformations which occur in a storage cell, we again refer to Mr. Roberts' concise and able article in this issue.

To prevent sulphating it is necessary to keep the sulphuric acid in the cells at a uniform specific gravity. This specific gravity is continually changing in use, and if the cells are not attended to the current will weaken because of sulphating, and the plates will require limbering up—a tedious process. A too rapid discharge is very apt to produce such conditions.

In stationary work a large amount of acid can be used, and with expert care the danger of sulphating is almost eliminated, but in motor vehicles, where weight is of prime importance, as little acid as possible is used and the chemical adjustments are far more delicate.

The charging and discharging of a storage battery requires the greatest care to prevent injury to the cells. Too rapid accomplishment of either process is attended with increased heat and internal resistance, leading to buckling, short circuiting, or disintegration.

It seems impossible to store power artificially without excessive weight. All attempts to materially lighten the storage battery have ended in failure, for lead is the source of power, and lead is lead to the end of reckoning, and it is not vouchsafed to man in Nature to get something out of nothing.

We will now examine more closely the imperfections of this type of vehicle, prefacing the examination with a brief review of the circumstances which have brought it so prominently before the public in the United States.

Since the beginning of the horseless vehicle movement on this side of the Atlantic, the electric vehicle has been most extraordinarily and imprudently boomed. It is superficially the easiest mastered and the most attractive of the motive powers. To one who knows nothing of storage batteries and is "coached" only in the beauties of the rotary electric motor, it seems a very simple problem. In fact, as is so often naively remarked by innocent inventors in this line, "it would be the ideal vehicle if it were not for the battery." This fatal defect, however, was carefully concealed by the promoters of the electric vehicle. Through the extension of the trolley system

here, the electric motor for traction was highly perfected and other data gained from this source were ready to hand. Large capital was invested in the electrical industry, and trained engineers in numbers responded to the call. The public was eager for any kind of a motor vehicle; steam and gasoline required time to develop, and the way for the electric promoters was therefore made easy. But easy as the way was, the storage battery would not stand it, for it is virtually the same battery which has over and over again failed in such work, and is afflicted with all the ills so familiar to storage battery experts. Yet it is at present the only source of power available for electric vehicles.

The chief drawbacks of the electric vehicle for ordinary commercial purposes may be briefly summarized as follows:

Weight.—This is a decided limitation in all storage power systems for vehicles. Weight begets weight. The greater the power stored the greater the power required to carry the power and the heavier must the vehicle be in all its constructive parts. In other words, the added power consumes itself and is not available for useful work. If the battery is lightened as we have seen, it is done at the expense of durability and capacity, and the radius and general serviceability of the machine are curtailed. Great weight also renders the battery more susceptible to the shocks and vibration of the road, increasing the liability of the plates to short circuit and buckle. Expensive rubber tires must therefore be resorted to in order to save the batteries as far as possible, but these merely add another horn to the dilemma of the commercial electric vehicle. Without them it is not to be thought of; neither is it practical with them, for rubber tires cannot stand the weight of the batteries, and the cost of tires vies with the cost of maintaining batteries in the total expense account.

Delicacy.—This phase of the storage battery has been touched upon under the previous heading, and is admirably elucidated by Mr. Roberts in his article on another page. The storage battery is a delicate subject in stationary work; in vehicle work, such as cab or delivery service, it is as often in the hospital as it is in service. Improvements in mechanical construction have slightly lessened these difficulties, but the delicacy is nevertheless inherent in the nature of the material employed for the plates and in the construction of the cells. Sulphating, buckling, short circuiting and disintegration are dangers to which storage batteries in vehicles must constantly be exposed until some radically different cell is discovered.

Cost.—Promoters of the electric vehicle continually harp on the cheapness of electric current when a large installation is put in, as in the case of a company operating public cabs, but say little of other items, far more important to the inquirer—items which mount rapidly when the roads traversed are rough and intersected by street car tracks, which rack the whole overloaded structure, throwing gears out of line, straining the wheels in every part, and wasting power which can ill be spared from a storage battery of limited capacity for its weight.

Small radius.—This objection is of little import in certain classes of urban service where the distances covered are not over 10 or 12 miles, but where the distance exceeds the latter figure the electric vehicle can hardly be counted on for reliable and continuous service. It is not well to discharge a storage battery too far nor too rapidly; the more even the tension is kept the more durable the battery, and the less the liability of buckling and disintegration.

We often hear it asserted by motor inventors, with a certain air of triumph, that their systems will drive a vehicle, i. e., make it run, as though this settled the question. The problem, however, is not merely to make a vehicle run, but to do it profitably in competition with other motive powers offered for the same work. In ordinary commercial problems economy is the deciding factor, and judged by this standard, the electric vehicle is banished from the broad field of the workaday world to the more limited field of luxury and incidental uses where the prime movers for special reasons are not wanted. The storage battery constitutes its limitation. The history of storage battery traction is strewn with wrecks and failures. In the street railway field, where the conditions are far more favorable because of the smooth track the car runs upon, hundreds of thousands of dollars have been vainly spent on "new," "wonderful" or "radically new" storage batteries, which were found to be essentially the same as others that had gone before to the scrap heap. At Washington, D. C., a few years ago, most extensive and disastrous experiments were conducted on the Metropolitan Street Railroad, ending in the usual way with the resumption of horse power. On the Madison Avenue line, in New York, some eight years since, the Julien storage battery system came and went quickly to the limbo of mechanical failures. About three years ago a storage battery car was sometimes seen creeping along the Grand Street line in New York, but as this was about simultaneous with the launching of the electric cab promotion in New York City, no particular importance need be attached to it. Between Birmingham and Bournbrook, England, a storage battery car is now running. The weight of the car is seven tons; it earns 15d. per mile and costs 18d. per mile. Always and wherever storage batteries have been tried on street cars, they have been speedily abandoned in favor of some other system for the invariable and all-sufficient reason that they did not pay. If storage batteries are not economical on tracks, how can they be economical on roads?

The editor of The Horseless Age believes the electric vehicle has a place in the new locomotion. Its high cost, simplicity of control, and undeniable æsthetic features commend it to the rich, especially to ladies, for urban use, and it will undoubtedly find other incidental uses, where the demands made upon it are light, but it has no place in the same category with gasoline, kerosene or steam vehicles, which generate power direct and are cheaper both in first cost and in operation.

As to the possibility of radical improvements in methods of

storing electricity, these do not seem likely. Minor improvements may be looked for, but greater strides will be made in the perfection of the prime movers with which electricity is striving to compete. In short, of this as of all storage power systems it may be said that until the laws of the universe are superseded, and a straight line ceases to be the shortest distance between two points, secondary powers cannot compete with primary in the broad fields of work, but must be limited to specialties outside the common pale.

Manufacturers, promoters and inventors who are attempting to force electric trucks, cheap public cabs, omnibuses and other strictly commercial vehicles upon a credulous world, should review the foregoing axioms, candidly remember their own experiences and spare the public further outlay of time and money. Such vehicles are not even good advertisements, for they cast suspicion on either the motives or the intelligence of those who advocate them.

Annual Statement of the Electric Vehicle Company.

At the annual meeting of the Electric Vehicle Co., held Sept. 19 in Jersey City, Isaac L. Rice, the president, submitted the following report:

STATEMENT OF EARNINGS.

From Jan. 1 to Aug. 31, 1899:	
From patent licenses	\$155,000.00
From sale of vehicles	412,143.15
From other sources	6,387.51
Total gross earnings	573,539.66
Contra—	
Legal expenses	\$9,257.76
Taxes	8,703.59
General expenses	17,600.32
Contingent expenses	4,722.20
	\$40,283.87
Net earnings	\$533,246.79
Dividends paid	324,800.00
Undivided profits	\$208,446.79
The profit on investments, according to market values on Sept. 1, 1899, amounts to.....	
	\$1,028,000.00
Total undivided profits	\$1,236,446.79

TREASURY RESOURCES.

The treasury resources of the company on Sept. 1, 1899, were as follows:

Cash	\$1,575,184.98
Securities (market value)	2,268,000.00
Other securities (appraised value).....	2,027,961.11
Sundry debtors	32,580.77
Bills receivable	158,000.00

Vehicles in process of construction (ordered before the organization of the Columbia and Electric Vehicle Co.) and materials on hand, less accounts payable 55,573.22

Total treasury resources \$6,117,290.06

The report then continues:

The immense demand for automobiles which has arisen during the past fiscal year made it necessary to organize the business of the company on a large scale, substantially as follows: The first step in this organization was the union of patents owned by the Pope Manufacturing Co. for the construction of automobiles, and of those owned by the Electric Storage Battery Co. for the manufacture of storage batteries as far as applicable to automobiles. This was brought about by the organization of the Columbia Automobile Co., in which the Pope Mfg. Co. and the Electric Storage Battery Co. became half owners respectively. The Columbia Automobile Co. then in its turn united all the patents owned by it with those owned by the Electric Vehicle Co., through the instrumentality of a new corporation entitled the "Columbia and Electric Vehicle Co.," reserving only its right to the manufacture of storage batteries, agreeing, however, to furnish these batteries as required by the Columbia and Electric Vehicle Co. at a price fixed at 20 per cent. above the actual cost of production. The stock of the Columbia and Electric Vehicle Co. was taken in equal proportion by the Electric Vehicle Co. and the Columbia Automobile Co. respectively. The Columbia and Electric Vehicle Co. acquired immediately, by purchase, the extensive plant of the Columbia Automobile Co. at Hartford and shortly thereafter purchased the entire capital stock of the New Haven Carriage Co., and thus acquired control of that company's important plant at New Haven. About the same time the Electric Vehicle Co. purchased substantially the entire capital stock of the Siemens & Halske Electric Co. of America, for the purpose of utilizing the great facilities in Chicago of that concern for the manufacture of the electric equipment other than storage batteries required for the construction of electric vehicles.

By means of this manufacturing organization the Columbia and Electric Vehicle Co. is in a position to furnish during the coming year an output of at least 8,000 automobiles, representing at present prices a gross business of about \$20,000,000. The exclusive right to purchase the entire output of the Columbia and Electric Vehicle Co. is assured by contract to the Electric Vehicle Co., which thus becomes the sole agency for its disposal.

In order to find a regular market for the product of the Columbia and Electric Vehicle Co. the Electric Vehicle Co. has adopted the policy of organizing transportation companies throughout the Union, each vested with the exclusive right to purchase for operation and sale within its territory the product controlled by the Electric Vehicle Co. At present four of such companies have been placed on a business footing. These are the New York, the New England and the Illinois Electric Vehicle Transportation companies, each with an authorized capital of \$25,000,000, all of which has been subscribed for. In addition to these, the company made an arrangement substantially similar with the Pennsylvania Electric Vehicle Co., which had been previously organized, and subsequent to its organization acquired its rights from the Electric Vehicle Co. The Pennsylvania company was capitalized as follows: Two million dollars preferred stock, \$4,000,000 common stock. The preferred stock, of which 20 per cent. has been called, is payable in

cash; the common stock was issued full paid for patents and rights.

The New York, New England and Pennsylvania companies were pioneer organizations antedating the Columbia and Electric Vehicle Co. They paid into the treasury of the Electric Vehicle Co. the sums of \$80,000, \$25,000 and \$50,000 respectively for the privileges conferred. The Illinois Vehicle Co., for these same privileges, has paid 20 per cent. of its full-paid capital stock, one-half of which has gone into the treasury of the Electric Vehicle Co. and the other half into the Treasury of the Columbia Automobile Co. All future companies organized for a similar purpose will be required to make similar payments for the privileges to be conferred. It may be noted that the entire capital stock of the transportation companies, with the exceptions stated, was subscribed for at par for cash without intervention of any underwriting syndicate, so that the respective companies received the full amount of the subscriptions without deduction for commissions or bonus of any description. The New York and New England companies have called 10 per cent. on the subscription. The Illinois company has called 5 per cent. and is about to call 5 per cent. additional. The large sum of \$7,400,000 in cash is thus immediately available for the purchase and operation of the product controlled by the Electric Vehicle Co., while the total amount of \$72,000,000 will become available as required. The request for the organization of further transportation companies throughout the Union is continually growing, and it is expected that within a comparatively short time every State will be supplied with such a company.

By its half ownership of the stock of the Columbia and Electric Vehicle Co. the Electric Vehicle Co. becomes entitled to one-half of the profits of manufacture, which in all cases are fixed at 20 per cent. above cost, making the profit accruing to the Electric Vehicle Co. 10 per cent. on the entire product.

As a special consideration for privileges especially conferred by the Electric Vehicle Co., each of the transportation companies organized or to be hereafter organized is obliged to pay to the Electric Vehicle Co. 2½ per cent. of its gross earnings of operation and 10 per cent. as a commission on all sales of vehicles not operated by the transportation companies.

The ownership of the Siemens & Halske Co. enables the Electric Vehicle Co. not only to obtain the profits arising from the general business of that company, but in particular to secure a manufacturing profit on all electrical equipments required in the construction and operation of electric vehicles manufactured by the Columbia and Electric Vehicle Co.

In order to bring about the manufacturing organization above described large sums of money were necessary. The company therefore sold at par for cash the preferred stock remaining in its treasury unissued at the beginning of the fiscal year; 19,400 shares were purchased by the Storage Battery Co. and 20,000 shares by a syndicate. No commissions or deductions of any nature were allowed in these transactions, which, at the time, corresponded substantially with the market price of that portion of the stock which had been issued. At the same time the common stock of the company was increased by 20,000 shares, which were issued full paid to the Electric Storage Battery Co. in exchange for valuable rights granted by that company. Of the amount realized about \$1,000,000 was paid for the stock of the Siemens & Halske Electric Co. and the furnishing of the working capital necessary to put that company on its present basis; \$600,000 was paid for 6,000 shares of the Columbia and Electric Vehicle Co., being half of the stock thus far issued, and \$1,240,000 was invested in the stock of the transportation companies, as above stated.

The company is entirely free from bonded or floating debt.

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Facts About Storage Batteries.

By Isaiah L. Roberts.

Probably there is no device now commonly used by mankind which is shrouded in so much mystery as to its internal operation as is the common storage battery. The average intelligent citizen knows that a steam engine is operated by the driving of a piston back and forth in a cylinder by the pressure of the steam behind it, or that a wind mill is caused to operate by the sails or blades being pushed by the force of the wind which strikes them; but the operations going on in the storage battery, both in charging and discharging, are far more subtle than any operation in mechanics. For the above reasons a large amount of capital and time has been wasted in doing the wrong thing, when a little real knowledge of the underlying principles involved would have saved much of both.

In looking over the history of the storage battery from Planté until to-day, one is surprised at the amount of work done and the small advance made. Numerous patents have been obtained and in many of them great hopes were placed that at least the ideal battery had been discovered. Finally, however, after much testing by actual practice, the fatal defect appeared, and the interested ones went their ways, having in most cases added something to their store of knowledge if not to their bank accounts. The reason of all this is that the storage battery is almost wholly an electro-chemical problem, and has but little mechanics in it, while the efforts have been made almost entirely on structural lines. To prove this it is only necessary to take copies of the patents, beginning with Faure's famous discovery that oxide of lead could be mechanically applied to the surface of the lead electrodes instead of "forming" it on them, as was the case with the Planté type. This was the first mechanical mistake, but it was followed by a host of others in rapid succession, each worse than the other, if possible. Few took the pains to investigate what caused the Planté cell to store electricity, but it was assumed generally that all that was necessary was to get oxide on to the positive plate and reduced lead on the negative plate somehow, without regard to the laws of electro-chemistry.

Without going into names, dates and places, I may say that it was after awhile found that the old Planté battery was better than the best pasted cells. Then the question as to why came up, and investigation showed that want of contact—"electrical contact," that first puzzle to the beginner in the application of electricity, good connection of one conductor to another—was the trouble. Electricity of the tension used in storage batteries will not pass over a space or through a non-conductor, however thin. The novice in electricity is often much surprised when he twists his half-cleaned wires together (to him) in the most reasonable manner, and attaches the ends to his bell or pea lamp, to find no ring or light. The first lesson in electricity is to have clean connectors and terminals; otherwise poor or no contact. Now, this is no less necessary in the construction of a storage battery plate than it is in line wiring. When oxide of lead is merely painted or laid against a sheet of lead and held there even under a slight pressure, it is all useless except those molecules which actually are in contact with the lead plate, because the oxide of lead when applied is a non-conductor and as such is not only of no use unless it can be made "active," but is in the way.

When this was found out many mechanical means, some of them quite ingenious, were devised for forcing the oxide of

lead into holes or convolutions in the plates. Some of these had slight merit, in that they got much more surface for the contact lead oxide, but another difficulty arose. It was found that the low oxides of lead used in the said holes or convolutions, when formed into peroxide, as it must be in order to become "active," occupied a considerably larger space than before and caused the plates to expand and "buckle," especially the latter if severely or rapidly charged.

It became necessary to get some hard substance to prevent this buckling which could be substituted for the lead. This was found in an alloy of antimony and lead. The antimony not being harmful, it gave hardness and rigidity to the plate. The oxides could be put into holes and held there more forcibly. This form of plate is now generally considered the best mechanical device up to date.

Various methods of etching by electrolysis or chemical methods where lead is used have been tried whereby the oxides might be formed more quickly than by the Planté method. Some of them have been more or less successful and one is claimed by some experts to be better than the filling in the holes or convolutions mechanically. However this may be, the quantity of energy that any lead storage battery will receive or yield depends directly on the amount of conductive crystalline structural peroxide of lead that is in electrical contact with the positive element. I have said nothing so far about the negative plate or element. This element is not so much of an offender, because the oxide on it is much more easily reduced, and once reduced gives but little trouble, whether in the Planté or Faure type, as oxide, when reduced to the metallic state, does not expand and adheres well. However, if the battery be too rapidly discharged buckling, where lead plates are used, will occur, owing to the more rapid oxidation of the plate when nearer its positive mate in one point than another, as the current seeks the lines of least resistance, which are in a storage battery the shortest distance between the plates at any point.

Having now outlined the principal mechanical points of the storage battery, we will take notice of what goes on chemically.

If we now take two plates of antimony-lead alloy and make as many holes in them as we can and yet leave a good margin of strength, and fill these holes with oxide, chloride or sulphate of lead, either under high pressure or by fusing them first into button form, and then pressing these buttons into the holes, we have like conditions on both plates. If oxide of lead is used we must place these plates in an electrolyte of sulphuric acid and water and pass a current of electricity through the plates and the solution. On one of the plates oxygen gas will be evolved from the water and on the other hydrogen. The oxygen will be absorbed by the sub-oxide of lead, which will be converted into peroxide of lead, and this plate becomes the positive in the storage cell, while the hydrogen evolved from the other plate takes the oxygen from the oxide on it and reduces it to the metallic condition, and this plate becomes the negative.

If a salt of lead is used to fill the holes, say chloride of lead, the chlorine from the chloride must be removed by electrolysis completely from both plates before using in a storage cell. After the removal of the chlorine the plates are then put into the sulphuric acid and both are treated by electrolysis, as was described in the case of the use of oxides, and with the same results.

We will assume that the positive plate is charged with one of the lower oxides of lead—say red lead Pb_3O_4 —and the

negative with litharge— Pb O . As the positive plate is mechanically charged with lead oxidized up to the point of Pb_2O_3 , electric storage begins from this point. Now, as soon as there is one molecule of peroxide— Pb O_2 —formed on the positive plate storage has begun and goes on until as much of the lower oxide is converted into peroxide as is possible, and there storage stops and nothing further can be accomplished by continuing the charging current.

We have now more or less of the oxide on the positive plate converted into the peroxide, while on the negative plate the low oxide is reduced to lead in a finely divided but coherent spongy metal. The battery is now charged. If we now connect this battery to some conductor and close the circuit through some work to be done, as a lamp or motor, the oxygen in the peroxide in the positive plate begins to oxidize the reduced lead sponge on the negative plate by electrolysis, and in doing so yields a portion of the current which it required to force it into the peroxide molecule. This action will go on until all the spare oxygen in the peroxide is transferred to the negative plate and there forms sub-oxide— Pb_2O —and litharge— Pb O —when the battery is discharged.

This can be repeated as often as desired. Unfortunately, however cunningly we may place the oxide into or onto the positive plate, we can never convert it all into the peroxide, because it is not a conductor to begin with and therefore action must begin at the surface of the plate and work outward. Now, as even the peroxide is only a poor conductor compared to the metal plate, the first film next to the metal must act as a conductor to the next or adjacent layer of oxide molecules and cement them by good "electrical contact," and so on outward as far as this change can go, and, as I have before said, this cannot go to the outermost layer. In fact, it can only go a short distance from the metal plate. Now, if from any cause a portion of this layer of peroxide becomes detached by a jar or by gas being formed on the plate under it, as both frequently happen, it is then worse than useless, because it remains peroxide. Its oxygen is not then available for transfer, as its contact with the plate is lost, and it frequently falls to the bottom of the containing jar or cell and may act as a conductor and thus "short circuit" the cell and thus render it useless until removed. Hence, it is necessary to raise the plates a short distance from the bottom of the cell, so as to prevent these detached pieces from coming in contact with the plates. Where batteries are used roughly, as is the case in all portable batteries, especially such as are in use in automobiles, only the amount of oxide which can be made available should be used on the plates. It is unfortunate also that in discharging a lead storage battery we can never get back all the energy we put into it, owing to an inherent difficulty which the law of chemical affinity enjoins, and that is this: We must use enough energy to take away the oxygen from one molecule of sub-oxide of lead on the negative plate, which tends to keep all it has because it has a strong affinity for what it has, and it holds on with a certain force. Having robbed the sub-oxide, we force a satisfied molecule of a higher lead oxide on the positive plate to take another atom against its will, and it resists this with a certain force. The combined resistance of these molecules in this forceful transference amounts to about one-half a volt. Now, after forcing this oxygen atom to take its place in a molecule of peroxide, it will go back to its old alliance, but will not pay back one cent of its cost of transportation. This means that we must use about two and one-half volts to make this transference in charging and get back less than two volts in discharging. But if the peroxide gets

detached we have lost all the energy the amount detached contains.

It is also unfortunate that so far lead is the only metal that can be used for storage purposes. It is a comparatively heavy metal, and while only slightly soluble in sulphuric acid, it forms quite readily sulphate of lead from certain of its oxides, hence in the management of storage cells great care should be exercised in discharging the battery, for if too fully discharged certain oxides formed will unite with the acid and form sulphate, especially if the cell is allowed to stand unused for a short time. This is termed "sulphating." Hence, if a cell is discharged it should be either immediately charged again or the acid be removed and plates washed with clean water.

As previously shown, only a portion of the oxide on the positive plate can be made available, and of the total amount of oxygen contained in the peroxide— Pb O_2 —we can only use one atom from two molecules, making a new molecule out of the two— Pb_2O_3 , which will not yield any more, as it is then satisfied. Hence the great weight of battery necessary to contain a small amount of energy.

Electricians are often asked how much energy is contained in a fully charged cell of a certain weight and size. This is about as intelligent a question as "How big is a piece of chalk?" For instance, if we wish to construct a light-weight cell and yet get the same yield per square foot of submerged plate, we must do that at the expense of the metal in the plate and not by using any less oxides on or in them, for the reasons just given. If we go far in this direction we can get a battery which will show comparatively fine results on test, but will not be so durable, because the plates are thin and weak, and if lead plates are used, as is generally the case, each charge "bites" or oxidizes a little more of the positive plate (*à la* Planté) and will soon destroy the plate or weaken it too much for use. When such batteries are used they are short-lived.

Hence the most successful use of the storage battery to-day is in central station work, where they can be made as large and strong as desired and set on strong foundations, where they are never moved or shaken. Here they have come fully up to the work required of them when that work was calculated by experienced battery men.

No great durability should be expected of a lead storage battery which is constructed to yield in effectual work day by day over four watt hours per pound of cell, solution, plates and connectors, and less than this is desirable for economical longevity. With lead we have started and seem to have ended, but I still believe that somewhere in the domain of chemistry there must be a better combination than the one described above.

Storage Batteries for Vehicles.

By A. H.

There are three distinct methods of equipping motor vehicles with power:

1. The vehicle carries fuel proper (oil, coal, coke), the latent energy of which becomes liberated when ignited and is used as heat in some disguise or other in the propelling motor.
2. The vehicle carries no fuel or source of power and is equipped with a motor fed from some external source of energy as it proceeds (trolley car).

3. The vehicle carries a supply of stored energy (air, super-heated water, electricity) feeding its propelling motor.

The latter is the underlying principle of the favorite motor vehicle of this country—the electric vehicle—the exploitation of which has already engaged large sums of money. It may be said that the electric vehicle is the ideal motor vehicle for many reasons, were it not for the battery. The latter, in fact, is the curse of the electrician. The thing is wet, as Edison said, and it certainly is most unmechanical and unreliable so far. The exact theory upon which an accumulator works seems not to be known, and even as regards the common understanding of the battery, the mistaken idea seems rooted in many minds that it stores “electric current”—so many amperes as the mark says on the cell—and that these can be drained off for any length of time.

The fact is that a storage battery accumulates energy introduced as electrical potential energy, transformed and stored within as chemical potential energy.

If we fill a tank with 100 gallons of water and lift it 33 ft. high it will represent a mass of water weighing 1,000 lbs., which, if allowed to escape within one minute passing through the bucket wheel of a turbine, will rotate the latter and generate 1 h.p., which we know is 33,000 ft.-lbs. per minute. The performance will last one minute.

If now we regulate the flow so that it will take 10 minutes to drain the tank the turbine will rotate and generate 1-10 h.p. only, but the performance will last for 10 minutes. An electric battery we can well compare with this tank and its electric energy with the mechanical energy represented by a weight descending from a higher to a lower level of gravitation. The current corresponds with the weight and the pressure (tension) with the height of level above the floor.

SIMPLEST FORM OF STORAGE BATTERY.

The first electric accumulator built, or rather the accumulator in its simplest form, consists of two metal plates (preferably lead plates) submerged in an acid (preferably dilute sulphuric acid). If such a cell be connected to the two poles of some source of electricity the following process will take place. The electric current entering at the positive plate will flow through the electrolyte (dilute acid) according to the internal resistance, and return to the electric generator through the negative plate. The plate connected with the positive terminal where the current enters is called the anode, from the Greek *ana odos*, “up the way”; the other is called the “katode.” The latter battery terminal is usually marked with a horizontal mark, the mathematical sign of the negative.

Assuming our plates to be of lead, and lead is almost exclusively used for the purpose, we will soon find in watching the charging cell in its glass case that the anode changes its appearance in a short time, due to the coat of lead peroxide with which it soon becomes covered and which in its turn is due to the oxygen produced all around it through the decomposition of the water (electrolytic action of current).

Water (having the formula H_2O) becomes under the influence of the electric current decomposed into its constituent hydrogen and oxygen. The first element becomes generated at the “katode,” and when nascent acts reducing on the lead sulphate of the plate, which latter has been formed through the action of H_2SO_4 on the lead.

Thus the free hydrogen reduces the lead sulphate to metallic lead and forms sulphuric acid. (This change which the liquid undergoes when the cell is being charged accounts for the di-

lute acid becoming specifically denser as the charging continues; usually its density increases from 1.1 to about 1.2.)

The oxygen, too, generated at the “anode,” combines with the sulphate of lead, oxidizing the latter and forming lead peroxide PbO_2 , and again sulphuric acid.

Again, comparing a storage battery with an elevated tank into which we force water with a pumping engine, we know that when we discontinue pumping in the latter case and have no check valve preventing the column of water to fall, the latter will reverse the direction of its flow and run the engine backward, returning all the energy invested in it during the process of charging, minus the part spent in internal friction, heat, etc.

Returning to our battery, we find that a similar state of affairs prevails here. We discontinue the charging process and connect the two battery terminals by means of a galvanometer. We find that the direction of the current which now flows is reversed and that it is weak, owing to the peroxide of lead coating formed on the anode being a very thin layer. The density of the electrolyte in discharging decreases.

To increase the capacity of the plates we must charge and again discharge them quite a number of times. The reason is this: Every time there is oxygen in its nascent state (charging) the lead is attacked on its surface and through its oxidizing action forms a fresh film of peroxide of lead. The nascent hydrogen reduces the “katode” every time to pure lead and the plates become gradually of a spongy nature and thus “develop their active surface”—opening up, as it were.

PLANTÉ AND FAURE CELLS.

This process of making a cell “active” was first used by Planté some 40 years ago, and the original Planté cell consisted of two strips of lead separated with thick flannel tape, rolled together and immersed in dilute sulphuric acid contained in a glass cylinder. With the exception of a change in the arranging of the electrodes and in the material used to separate the two plates (flannel or other organic matter will not resist the action of H_2SO_4), the Planté type of cell is still much used, and for the sake of reliability and another reason which we shall discuss later, it is much in favor.

With the view of constructing an efficient cell without the tedious and expensive “forming” process which we have just described, Faure in 1880, in France, and Thomas Parker, in England, coated the plates of the Planté accumulator with a paste of lead hyperoxide (red lead, or minium) (Pb_3O_4) which becomes thoroughly spongy in a short time and which adheres to the lead plates well.

The names of the different existing types of battery and those which have already disappeared from the field, is legion; yet their underlying method of construction is either the one or the other of the two above mentioned—using either “formed” or “pasted” plates.

There are also accumulators using zinc, copper and alkaline, sal ammoniac dilute instead of acid, but they are of less importance.

Concerning the construction of batteries, it is customary to stamp the individual lead sheets or cast them so in moulds that recesses are suitably formed, thus increasing the surface and retaining the active material or paste on the plate.

Usually, but not necessarily, an uneven number of negative plates are connected together, the positive plates also being coupled to one common terminal. On account of the connections being attacked by the fumes of the acid it is good

practice to burn the lead ends together, dispensing with copper wire connections.

The trouble with early types of batteries was that the active material would crumble out and short circuit the element when gathering at the bottom. In most modern types this difficulty does not exist, as precautions are taken to prevent this accumulation and to distance the plates properly without preventing their expansion and contraction in action. Trouble was also experienced with the early types through excessive heating, as the plates were closely rolled together and there was no chance for the acid to circulate and get at the hot plates. Naturally such a battery would consume a great part of the electric energy to cope with its internal resistance. On the road and applied to motor vehicles the liability to disintegrate is enhanced, and for this reason formed plates are superior to pasted plates for the latter purpose. They will also allow of a sudden heavy rate of discharge, which as a rule would endanger a pasted plate. Many constructors put batteries in a spring bottom in the carriage box to minimize the influence of the vibration on the road.

As regards the efficiency of storage batteries, one must be skeptic in accepting many a maker's statement, or, in any case, one must discriminate in explaining the figures given. The efficiency as a rule varies from 70 per cent. to 85 per cent.; the pressure according to the density of the acid (the latter usually 1.15) rises when charging to about 2.6 volts and should not be permitted to drop below 1.8 when discharging. Many makers group 44 cells to be charged from a 110-volt standard supply of electricity.

The capacity of a battery varies according to the rate of its discharge in amperes per hour. The latter for stationary purposes is being taken very moderate to increase efficiency and durability.

To carry little battery weight we must discharge at a heavy rate, thus reducing efficiency and capacity. While for instance a cell may be capable of rendering 140 ampere-hours at the rate of 14 amperes, it would probably give 100 ampere-hours only when called upon to discharge at 30 amperes.

The most efficient batteries, used mostly for work where weight is of little object, have a capacity at a moderate rate of discharge of $3\frac{1}{2}$ to 6 watt-hours per pound of complete cell, while other cells at the same rate render up to 8 watt-hours per pound, one maker claiming as much as 10.

In automobiles batteries consist usually of 40 to 44 cells arranged in two or four groups, so as to make two or four electrical units available to vary speed and obtain starting torque by means of suitable wiring and the employment of an electric controller.

The Charging and Care of Automobile Batteries.

By Theodore D. Bunce.

It is certainly not necessary that the owner of an electric automobile should be thoroughly acquainted with every detail of the construction of his vehicle, both mechanical and electrical, any more than we would expect every driver of a horse to be a veterinarian. But if every owner were as conversant with the general make-up and needs of his machine as the experienced driver is in the care and handling of his horse,

this article would be uncalled for. It is probable that the majority of automobile owners will not care to study the scientific construction of the batteries that furnish the power for their machines, but they will wish to have a practical knowledge of their working.

In a general way the battery of the automobile may be compared with the horse. Both may be overworked with more or less disastrous results. The battery may, like its equine rival, be over as well as under fed, the latter condition in both being worse than the former. Both are the better off when not subjected to sudden starts and both will last longer if not constantly pushed to their utmost capacity. Both renew their strength and usefulness after a reasonable rest, and last, but not least, both require when ill the care of an expert—the horse the veterinary surgeon and the battery the skilled electrician.

The motor, while forming an important part of the mechanism, is more a part of the vehicle proper than the battery, and receives attention with the general care of the machine. It is not intended in this article to discuss the construction or care of the motor, but to explain in a practical manner the battery, as it is the vital part of the mechanism. The general features of the battery should be understood by the owner or driver in order to obtain the best service and to economize the power.

The storage battery of an automobile usually consists of 40 to 44 cells, generally divided into four groups of 10 or 11 cells each. Each cell gives from $2\frac{1}{2}$ volts when fully charged to 1.75 volts each when it has arrived at the lowest potential it should be allowed to reach on discharge. This gives a maximum of from 100 to 110 volts and a minimum of from 70 to 77. As the majority of direct current circuits that would be used for charging are from 110 to 120 volts pressure, it is readily seen why 40 cells is the best number to use, as the 110-volt circuit will always give the necessary excess of pressure required to force the current through the cells, at the same time requiring the least amount of resistance for regulating.

In the majority of automobiles the change of speed is effected by grouping the cells in sets. It is for this reason that a multiple of four is used for the total number. Thus $44 \div 4 = 11$, or $40 \div 4 = 10$. The mechanism for operating takes care of this grouping. It will be found on removing the cells from the vehicle that each set of 10 or 11 cells are permanently connected in series—that is, the positive of one cell to the negative of the next, and so on. In the vehicle each set is connected either automatically or otherwise to the wires leading to the controller.

In charging, all the sets should be connected in series—that is, the four groups connected together, the positive of one group to the negative of the next. This is generally provided for by the manufacturer of the vehicle when the battery is to be charged in the vehicle. It is generally accomplished by disconnecting the motor wires and setting the controller at full speed. This is obvious, as all the cells are used in series when the full power is to be developed. It is important, however, to remember to disconnect the motor wires before turning the controller to full speed. If it is desired to charge the cells independently of the vehicle, or an individual test of the cells is to be made, they may be removed and connected in series, leaving a positive pole at one terminal and a negative at the other. The positive pole is generally indicated either by a + sign or by a red mark. The negative pole is sometimes indicated by a — sign, but it is more frequently unmarked.

Up to this point we are considering the cells in groups properly marked by the manufacturer, and the individual polarity of each cell may be disregarded until we have occasion to remove them from the group.

The electrolyte or fluid used in the cells is a mixture of sulphuric acid and water. The strength of this solution varies with the state of charge of the battery. When the cells are fully charged the solution is at its maximum strength, and becomes weaker in proportion to the amount of current taken out. The solution does not require replacing except when the cells are to be dismantled for cleaning or repairs. There should always be sufficient in the cells to cover the tops of the plates, as any portion left exposed is inactive and will deteriorate rapidly. There will always be a slight loss by evaporation or spilling, but this may be replaced by the addition of clean water. But should any considerable amount be required, it is better to add acid, in order not to weaken the electrolytes. The plugs in the covers of the cells should be removed and the necessary water added to replace evaporation. A special rubber bulb with a small nozzle is made for this purpose.

The solution is a mixture of sulphuric acid and water of 22 degrees by Baumé hydrometer, or a specific gravity of 1.180. Preparing with a hydrometer is better than mixing by measure or weight, as the density of the pure acid may vary. With the commercial acid the proportions by measure are one part sulphuric acid and five parts water. The solution should be made in a stone vessel or lead lined tank. Put a sufficient quantity of water in the vessel and slowly pour in the acid, stirring it constantly with a glass rod or a piece of wood. The solution gets hot and becomes stronger as it cools. Test it with the hydrometer, and if it is of about twenty degrees let it stand until cold, when either acid or water may be added to make it the exact strength required. Do not let the acid come in contact with any metal but lead. The pure acid is exceedingly corrosive, and the prepared solution will destroy clothing if not neutralized at once by ammonia or some other alkali.

As it is impossible to use the hydrometer in the batteries made for automobile work, it will be necessary to withdraw some of the acid with a suction bulb or syringe, and a test made in a separate vessel. A convenient instrument is made for this purpose, called a hydrometer syringe. It is a combination of a suction bulb and a tube holding the hydrometer. As long as the cells are working uniformly it is not necessary to make any change in the acid, but should any cells be found of a low voltage, the acid will be correspondingly weak, and it may be difficult to make it recover its original strength by charging. If fresh solution is put in it should be diluted after the cell has been restored by charging, as the acid will then be found too strong. In no case ever pour the pure acid into the jar containing the plates.

The charging wires should be run to a convenient switchboard and should be connected to an ammeter, a rheostat, a main switch and the customary fuse block. The rheostat should be of large enough capacity to carry the maximum charging rate without overheating, and should have a sufficient number of steps for the regulation of the current. The polarity must be determined and the poles properly marked. If there is any possibility of the polarity being changed, a test with a polarity indicator should be made each time before turning on the current.

In most cases the cells will be charged in the wagon, and the directions given by the manufacturer should be followed.

The charging plug furnished with the wagon should be attached to a cable of convenient length and the ends connected to the terminals on the switchboard. The polarity at the plug should then be tested and made to correspond with the marks on it. It is then inserted in the receptacle on the wagon. The rheostat is set with all the resistance in circuit and the current turned on. If plenty of time can be allowed in which to charge, the normal rate should be adhered to, but if it is necessary to hurry the charging the maximum may be applied at first and then reduced as the cells begin to show signs of being charged.

As soon as the bubbles rise to the surface of the acid freely or the sound of bubbling can be plainly heard, the current should be reduced step by step as the bubbling continues, and if at the lowest point it still continues it is evident the cells are nearly charged. It is advisable to continue charging at a low rate, as there may be some cells below the others, and they will have an opportunity to catch up, while an overcharge at a low rate will not injure the others.

If a battery has been overdischarged it will be necessary to continue the charge for a longer time, as even the bubbling will not be a sure indication of its being up to its full capacity. In the latter case the battery should be taken out of the vehicle and the plugs removed from the cells, so that each cell can be inspected. The gas that forms from the bubbling is explosive, so as much ventilation should be given as possible, and great care should be taken to have no fire allowed near. The cells should be examined by an incandescent lamp. They should all bubble uniformly on a low rate of charge.

After a heavy overdischarge even a prolonged charge will not always bring the cells back to their original condition, but if the following discharges are moderate the subsequent chargings will restore them. It is always advisable to charge the battery as soon as possible after it has been used, and if convenient give it a short charge shortly before taking out the vehicle.

When an automobile is used every day two sets of batteries will be found of advantage, as there will be more opportunity to give them attention and a longer time to charge. In any case, frequent tests of the cells are recommended, as a fault once developed in a cell will become worse and lead to further trouble if not repaired at once.

We have endeavored to cover the principal points in the care of automobile batteries. Much more could be said of a technical nature. Other currents than the 110-volt circuit may be used for charging, but with the increase in the number of vehicles and charging facilities they will rarely be called upon.

A storage cell is made up of two groups of plates, called positive and negative. Each group has attached to it a connecting strip of lead. The plates alternate in the jar, so that one plate is of opposite sign to the next. They are kept from touching by various methods of insulation that allow of a free circulation of the solution. When the charging current passes in at one pole it reaches the next through the solution and effects a chemical change in the nature of the plates. When this chemical change is complete the cell is fully charged, and when the circuit is closed a reaction takes place and a chemical change of an opposite character occurs. This produces an electric current. No electricity is actually stored.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

LONDON NOTES.

BUSY WEEK IN ENGLAND.

London, Sept. 14, 1899.

The coming week will be a very busy one in English automobile circles. On Saturday, the 16th inst., the Automobile Club starts on its autumn tour to Folkstone and Dover, in which about twenty motor carriages and cycles will take part. On Sunday the bulk of the party will journey over to Boulogne, to witness the finish of the Paris-Boulogne race, while at Dover there is next week a two-days' motor show and also a motor race meeting in connection with the annual gathering of the British Association for the advancement of Science in that town.

NEW GASOLINE CARRIAGES.

The Beeston Motor Co., Ltd., of Coventry, which has hitherto devoted its attention to the manufacture of motor bicycles, is proceeding with the construction of a two-seated voiturette, provided with a $3\frac{1}{2}$ -h.p. gasoline motor. It will weigh, complete, about 500 lbs. A new four-seated carriage is also in course of construction by F. Jackson & Co., Ltd., of Oxford St., London, W. It will have a tubular steel frame, and be provided with two vertical gasoline motors, working on the same crank shaft and giving together about 5 h.p. The engines will be located in the front of the frame, the power being transmitted by belts direct to the rear axle, a special device being mounted on the latter to effect the change in speed.

A HUGE ELECTRIC WAGON.

I am able to send you herewith a general view of what is probably the largest electric delivery wagon in existence. It is being shown at the Motor Carriage Exhibition at present being held in Berlin, by the Giesserei und Maschinenfabrik Oggersheim (Paul Schütze), of Oggersheim (Pfalz), Germany, and has a carrying capacity of no less than 10 tons (?). The motor, which is of the "Hauptstrom" type, is geared to the front axle, the front wheels acting both as drivers and steerers. The length over all is about 20 ft. The battery consists of a large number of Colonia accumulators, supplied under guarantee by Leffer & Co., of the Colonia Accumulatoren-Werke of Aix-la-Chapelle. The capacity is 200 ampere-hours, sufficient, it is claimed, for a run of 30 kilometers at an average speed of 8 kilometers an hour. The controller switch is adapted to give a wide range of forward speeds, and also a backward motion. Huge as the vehicle is, the makers claim that it can

haul its load at speeds ranging from 6 to 10 kilometers per hour, according to the nature of the road traversed, and can ascend, at a low speed, naturally, gradients of 10 per cent.



THE OXFORD MOTOR CARRIAGE HOUSE.

It has transpired this week that the intrepid automobilist who proposes to undertake a journey by motor carriage from China to London is none other than Dr. Lehweß, of the Automobile Association, London, W. Dr. Lehweß is having a special Koch kesosene carriage built in Paris. It is proposed to start in March next, and Dr. Lehweß hopes to do the journey of 8,000 miles in about three months.

I have just received a copy of the programme of the autumn tour of the Automobile Club, which starts on Saturday next. One item of the programme shows in a striking manner one point of economy in favor of horseless vehicles, viz.: "Accommodation for the storage of motor vehicles will be provided by Mr. C. Huntley, Bonverie Mews, Folkstone, at a cost of 1s. 3d. per night." Just fancy, only 30c. for a night's stabling! How much would it be for a horse and trap?

At a recent meeting of the Hackney Vestry, the question of the adoption of motor dust carts and watering carts came up for discussion. Eventually the matter was referred to a committee for inquiry and report. Steam dust carts have been in use at Cheswick for some time past.

No less than sixteen horseless wagons are now plying for hire in the city of Newcastle-on-Tyne, and this number will shortly be increased to twenty-eight.



Some time ago the Motor Manufacturing Co., Ltd., of Coventry, decided to cease manufacturing the Werner motor tricycle, the principal cause being trouble with the incandescent tube ignition. I now learn that they are about to resume the manufacture of this machine in an improved form, the alterations taking the form of electric ignition and a motor of slightly greater power.

Something of a novelty has just been introduced at Newsham Park, Liverpool—a motor mowing machine.

The Liquid Fuel & Engineering Co., East Cowes, Isle of Wight, have acquired the works lately occupied by the Starley Bros. & Westwood Mfg. Co., Ltd. (in liquidation), at Adderley Park, Birmingham. Some idea of the extent of these works may be ascertained from the fact that they cover an area of over $3\frac{1}{2}$ acres, the main engineering shop measuring no less than 300 ft. by 200 ft. The plant was used for the manufacture of cycles and cycle fittings, and the new possessors hope to start operations at their new factory in less than two months. Is it a sign of the times to see cycle factories converted into works for the production of motor vehicles?

Messrs. B. King & Co., of the Ingersley Vale Bleach Works, Ballington, Cheshire, who have a heavy traffic between that town and Manchester, which has for many years been performed by horses, have just placed an order with the Steam Wagon & Carriage Co., Ltd., of Cheswick, for three Thornycroft steam lorries of the type which won the gold medal at the recent heavy motor trials at Liverpool.

There appears to be no diminution in the racing fever in France. It is now reported on good authority that M. Le-maitre, who came in third in the recent Paris-Ostend race, is having a new carriage built by Peugeot, which will be fitted with an engine developing less than 52 h.p.!

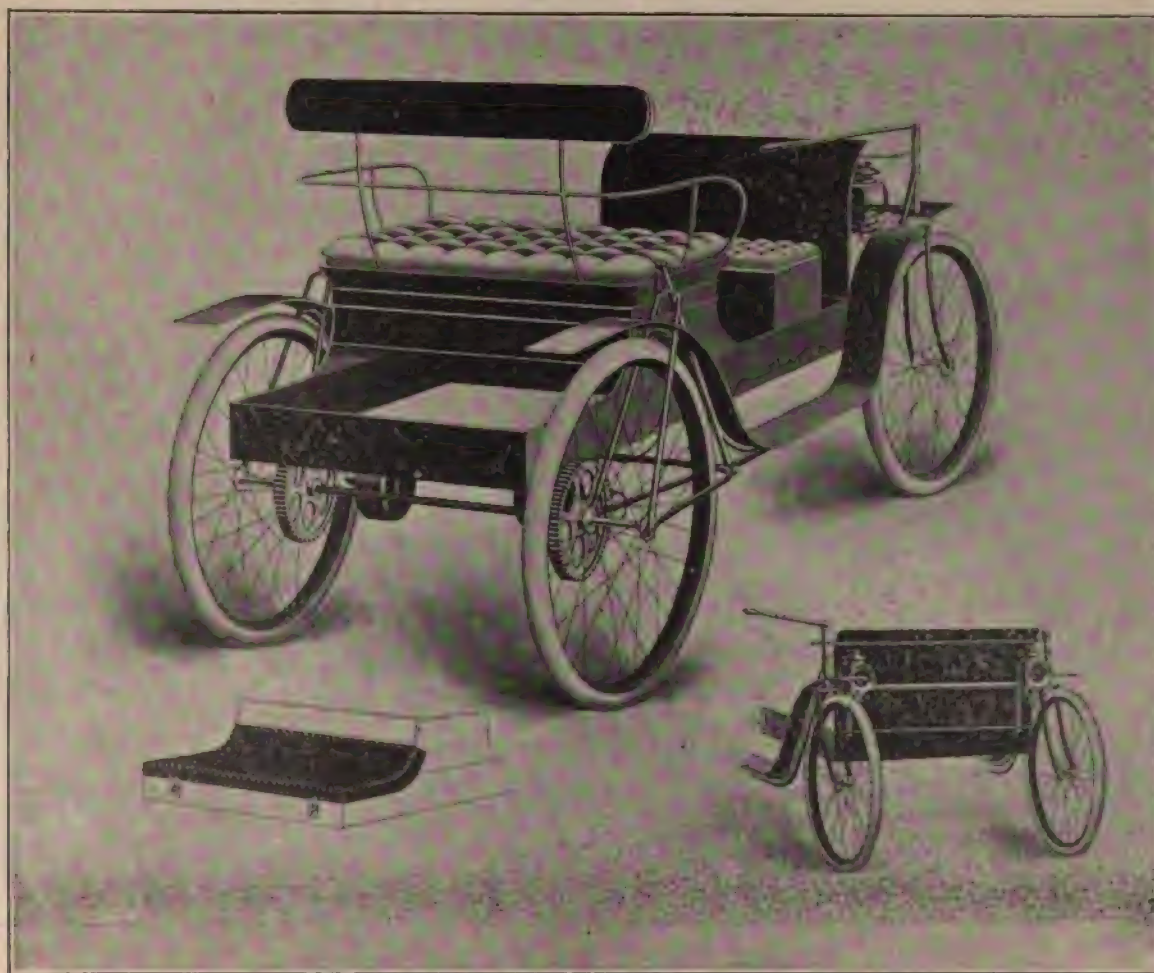
The Chapman Electric Carriage.

W. H. Chapman, electrician of the Belknap Motor Co., Portland, Me., is the designer of the light electric carriage illustrated here. The vehicle complete weighs 360 lbs., of which 180 lbs. is battery, and is intended for a light racing machine carrying one person normally and two on smooth roads. When only one person is riding an extra battery may be carried, bringing the mileage on one charge up to 40 or 50 on good roads, the normal mileage being about 20.

The frame rests on four 32-in. tandem bicycle wheels, with 4-in. tires. Two $\frac{1}{2}$ h.p. motors are used, each geared to the rear wheels by a 10-in. gear and run independently of each other 10 to 1.

Several different designs of body will be offered the purchaser, including a basket phaeton.

The manufacturers call it a "sulky electromobile." Frederick Ward, 60 State St., Boston, Mass., states that he has contracted for the entire output, and will probably open an office in New York.



CHAPMAN ELECTRIC CARRIAGE—BELKNAP MOTOR CO., PORTLAND, ME.

COMMUNICATIONS.

First Steam Bus in Norway.

Bergen, Norway, Sept. 5.

Editor Horseless Age:

Under separate cover I mail to you to-day a photo of my first steam omnibus for 20 passengers and take pleasure in accompanying it with a few details of the construction of the vehicle.

As you will easily see, there is no visible machinery under the body except the brakes, one of which is an automatic Lemoine. All the four wheels are 28 in. in diameter, with 4-in. tires. The front wheels act as steerers and drivers as well and will turn at an angle of 42 degrees.

The boiler is of the Toward water tube type and the engine has three cylinders with single-acting pistons working on three cranks set at 120 degrees.

The seating capacity is 10 persons inside and eight outside. The platform is furnished with removable windows for winter use and curtains for summer use, and the inside can of course be heated by the exhaust from the engine.

The total length of the wagon is 17ft. 4 in., the wheel base 9 ft. 6 in. by 5 ft. 4 in., height from ground to top 8 ft. 9 in.

The speed on the level is about 10 miles an hour and the wagon can mount hills 1 in 7 at the second speed.

Advantages claimed by the builder:

1. Front driving and steering are preferable because it is easier to pull a motor car from the front in the desired direction than it is for the vehicle to be forced from behind.
2. Total weight of machinery on the drivers, thus giving better grip on the road.
3. Easy starting by placing the drivers at a slight angle.
4. No. chains and machinery visible below the carriage.
5. Symmetric construction, giving the wagon an anti-horseless appearance.
6. Well balanced on the wheels and low structure, making the vehicle comfortable and steady.

Yours respectfully,

JACOB IRGENS.

[Ed. Note.—Mr. Irgens has been devoting himself to this line of work since 1892.]

Will Make Four-Wheelers Too.

Peoria, Ill., Sept. 22, 1899.

Editor Horseless Age:

To most people the word wagon suggests a four-wheeled vehicle, and when considering the motor vehicle they expect to see it with four wheels. When considered in the abstract there may be no reason why four wheels are better than three or five, and it is quite possible that either of these numbers would



STEAM OMNIBUS OF JACOB IRGENS, BERGEN, NORWAY.



have some advantage over the four-wheeler, but since many people look with suspicion on anything out of the ordinary, it is certainly good policy to supply four-wheelers when wanted, and in accordance with this policy, the Duryea Mfg. Co. and their licensees, the Peoria Rubber & Mfg. Co., both of Peoria, Ill., make their motor vehicles in the four-wheeled style shown herewith, although stating that they believe the three-wheeler to be superior in many respects.

The mechanism of this machine is similar to that used in their other goods, consisting of triple cylinder motor geared by chain to the driving axle for ordinary speeds, but having a power gear for hill climbing or reversing. The steering of the four-wheeler is effected by pivoted heads just inside the forward hubs, or centrally placed in the forward hub, as is shown in the illustration. Each method has some advantage, and either is used as circumstances dictate.

It will be noticed that these vehicles, like the three-wheelers, have the driving wheels well under the load, so that ample traction is secured, while the steering wheels are placed well forward, making a long wheel base which gives steady and secure steering.

The vehicle is quite low, being easy to get into and out of, and almost impossible to upset, which is a matter of no little importance when the high speeds at which these vehicles are driven are remembered.

Four styles of these machines are now ready for delivery, viz.: dos-a-dos, surrey, phaeton and delivery wagon, while cabs and coupés are promised in the near future.

DURYEY MFG. CO.

QUESTIONS AND ANSWERS.

At the request of many of our readers we have decided to open a department of questions and answers. We will endeavor to answer any detail question in practical engineering pertaining to motor vehicles.

That Knotty Steering Fork Problem.

Brooklyn, Sept. 22, 1899.

Editor Horseless Age:

I believe the only way to calculate Mr. McClintock's steering fork problem, published in your last issue, is by the "cut and try" method. A careful study of the table will be found of considerable assistance in arriving at the final result.

The proper angle of the outer wheel is found by the first table, or its accompanying formula, which I find in this case to be $29^{\circ} 23'$. The placing of the fork pivot $1\frac{1}{2}$ in. to the rear does not appreciably affect the result; in fact it rather favors the accuracy due to the shortening of the fork arms. My final "try" gave the following result (using the formula in last column of my article):

$$\begin{aligned}
 45'' &= \sin. .7071. \quad .7071 \times 5.5 = 3.88805. \\
 41^{\circ} 10' \text{ (final assumed angle of fork)} \\
 \frac{\quad}{2} &= 20^{\circ} 35' = \sin. .3515. \\
 .3515 \times 4.5 &= 1.58185. \quad 3.88805 - 1.58175 = 2.30730. \\
 \frac{2.30730}{4.5} &= .5127 = 30^{\circ} 51'. \quad 30^{\circ} 51' + 20^{\circ} 35' = 51^{\circ} 26'. \\
 51^{\circ} 26' + 20^{\circ} 35' &= 72^{\circ} 01' = \sin. .9512. \\
 .9512 - .3515 &= .5997. \\
 \frac{.5997 \times 4.5}{5.5} &= .4907 = 28^{\circ} 23'
 \end{aligned}$$

which corresponds with the proper angle of the outer wheel, proving that $41^{\circ} 10'$ is the proper fork angle.

Yours very truly,

HARRY E. DEY.

Questions in Heat and Pressures.

Jersey City, N. J., Aug. 21.

Editor Horseless Age:

Will you kindly answer the following: Given a cubic inch of water, liquid air, liquid carbonic acid, liquid ammonia, what is the cubic measurement of each in vapor at atmospheric pressure, and their respective temperatures then?

With similar quantity of heat applied to each of the latter under similar conditions in an inclosed vessel, will they each have the same pressure in the same time? And will the pressure continue rising so long as heat is applied?

What will be the pressure of this volume of carbonic acid vapor at 212° F.?

Respectfully,

J. D.

Answer.—For the purpose of this calculation let us assume the following data:

Table I.

	Boiling Point at Atm. Pr.	Specific Gravity at Boiling Pt. and at Pr.	Weight in Lbs. per Cu. In.
Liquid ammonia	30°	0.65	0.0235
Water	212°	1	0.0361
Liquid carbon and oxide..	110°	1.08	0.039
Liquid air	315°	0.94	0.034

If the liquid is evaporated at atmospheric pressure, the temperature of the vapor is presumably the same as the boiling point of the liquid in contact with the vapor.

The following table is calculated on the supposition that Gay-Lussac's law of variation in volume with change of temperature is applicable at all temperatures of a gas or vapor:

Table II.

	Vol. of 1 Lb. at 32° F. and at Pr.	Vol. of 1 Lb. at Boiling Pt. and at Pr. Cu. Ft.	Vol. of Gas from 1 Cu. In. of Liquid. Cu. Ft. Cu. In.
Water (vapor)		26.36	0.95 1640
Ammonia (gas)	21	18.4	0.43 744
Carbon and oxide (gas)..	8.1	5.75	0.23 398
Air (gas)	12.4	3.8	0.13 225

Column 2 is found by multiplying the figures in Column 1 by the absolute temperature of the boiling point, and dividing this by 492. Column 3 is obtained by multiplying the last column of Table I. (weight per cubic inch of liquid) by Column 2 of Table II.

Let us now assume, as desired, that each of these vapors is confined in a vessel just large enough to hold it at atmospheric pressure and at the initial temperature of the boiling point. Table III. shows the steps in the calculations for the increase in pressure produced by the supply of equal quantities of heat. The specific heat at constant volume is supposed to be the same even at low temperatures.

Table III.

	Specific Heat at Constant Volume.	B. T. U. per lb. and Weight in Each Vessel.	Increase in Temp., per B. T. U.	Increase of Pressure in Atm., per B. T. U.
Water vapor	0.37	0.0133	75°	0.111
Ammonia	0.39	0.0092	109°	0.254
Carbon and oxide....	0.17	0.0066	152°	0.435
Air	0.17	0.0058	172°	1.185

Column 2 is the product of Column 1 (Table III.), and Column 3 (Table I.), and gives the heat in British thermal units for the gas produced from the cubic inch of liquid. Column 3 is simply the reciprocal of Column 2. Column 4 depends on the applicability of Gay-Lussac's law for gases; it is calculated by dividing the increase in temperature (Column 3) by the absolute temperature of the boiling point, when the pressure was one atmosphere.

We thus see that equal quantities of heat do not produce equal pressures. As regards the question of time, that depends on the rate at which the heat is supplied, and on the conductivity of the various gases. Assuming these to be practically equal in the four cases we will not find equal increase of pressure at the end of any lapse of time.

To calculate the pressure of, say, the carbon and oxide at any temperature (212°), we divide the absolute temperature (212° + 460° = 672°) by the absolute temperature at which the pressure was equal to one atmosphere (— 110° + 460° = 350°), 672/350 = 1.92 atmospheres.

WILLIAM FOX,

College of the City of New York.

Milwaukee, Wis., Sept. 17.

Editor Horseless Age:

Will you kindly give me through the columns of your valuable weekly the rule, or title of a book containing it, for computing the indicated horse-power of gasoline engine (given the bore, stroke etc.) for various grades of gasoline?

Very truly,

W. B. H.

Electric Ignition.

Occasionally a query directed to my department is of such general interest that somewhat more than the usual amount of space may be profitably devoted to a consideration of the points suggested by the question. One of these practical communications is quoted herewith:

Geneva, N. Y.

Will you please give the best method of connecting up battery, coil, commutator and plug for the jump spark, with diagram, if possible? Also explain whether vibrator or buzzer is used or not, and oblige,

SUBSCRIBER.

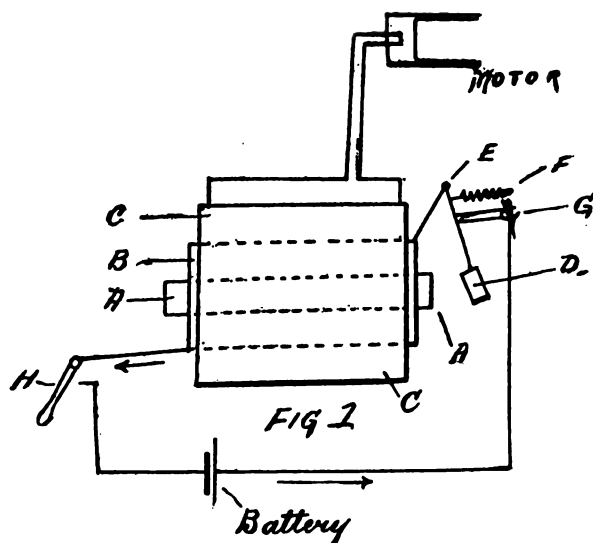
Where several arrangements have been devised for electric ignition, one may naturally dispose of the questions by explaining the general character of the devices and then leave the matter wholly to "Subscriber" to decide as to which method shall best serve his needs.

The source of electricity may be either a dynamo, a storage or a primary battery. As regards the first, I do not feel that it is necessary to do more than draw attention to the article on "Ignition Troubles" published in these columns by Viator. The storage battery is used to some extent abroad, especially on the De Dion and Bouton machines, but I do not remember seeing it adopted here for a like purpose. In primary batteries there is a wide range for personal choice, and as the points involved have received some attention in these columns not many months ago, we may dismiss the matter with the simple reminder that the battery adopted should be of such construction that the elements will not readily break down or short circuit under the stress of rough roads, etc.

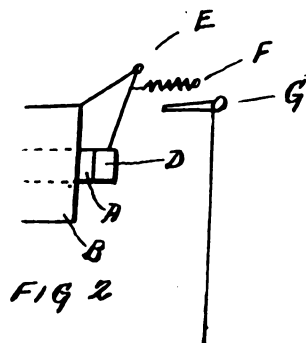
Provided the batteries were very powerful, we could attach a wire to the positive pole and another wire to the negative pole; then, on bringing the outer ends of the wires together and again separating them, we should obtain sparks at the junction that would suffice to explode a charge of carbureted gasoline if produced in the engine cylinder. This short circuiting of the battery is, however, prejudicial to the effective life of the cells and various means of prolonging the efficiency must be sought. One of the simplest is to pass the current through a helix around a soft iron core, or a bundle of iron wires, connect one pole to the engine frame and the other to an insulated platinum point in the explosion chamber. The platinum point comes in contact alternately with a wiper and an insulated deflector. The first, on leaving the platinum point, produces the igniting sparks, and the second forces the platinum and its support back into position to again strike the wiper with certainty. The extreme heat in the cylinder soon anneals any spring support that may be devised to hold the platinum contact point, and the deflector serves for that purpose. The wiper and the deflector rotate in the explosion chamber and are positively driven from the engine shaft. An arrangement similar to the one just described is in use on a large gas engine. Four elements comprise the battery; the coil is 7 in. long, with three or four layers of No. 14 wire; one wire goes to the ignition plug and the other is pinched under one of the cylinder-head nuts. The scheme is simplicity itself, but I fear the service is hard on the batteries; however, the expert who gave me the details declares it is perfectly satisfactory. As will be noticed, the vibrator is not necessary in a coil of that kind; where, however, a coil is prepared in two parts, primary and secondary, a vibrator becomes a necessity to rapidly make and break the circuit in the primary and thus by induction produce a current in the secondary coil of high intensity for brief periods. This may serve, I trust, for an answer to the latter of the two questions submitted.

In Fig. 1, A is the soft iron core, B the primary coil of thick wire, C the secondary coil of fine wire, D is the vibrator which swings freely on a pivot at E, F is a light spring to bring back the vibrator D against the terminal G, at H is a simple switch.

Let us now move the switch H to connect up the wires and the current flows from the battery to the right, as shown by

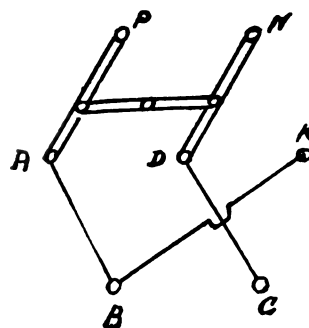


the arrows through G, by way of the vibrator D and pivot E around the coil B back to the battery. Now, when a current passes through a coil around a soft iron core the latter instantly becomes a magnet; hence, the vibrator D is at once drawn to the end of the core A; this breaks the connection at G, and the core being demagnetized the spring F pulls the vibrator again into contact with G and the action starts anew. This rapid interruption of the main circuit induces a current in the secondary coil of such intensity that it leaps in a succession of sparks across the air space between the points in the cylinder and thus explodes the charge. Fig. 2 is given to illustrate the position of the vibrator when contact is first made at the switch.



In the way I have shown the device a switch is turned by hand to complete the circuit; this is all right so far as it goes, but evidently another switch is necessary to automatically close and open the circuit as required at each working stroke. This second switch may be in the form of a commutator, for it is conceded that the reversal of the current improves the efficiency of the sparking device. I illustrate in Fig. 3 the idea which governs the connections. Here the two levers are connected, say, by a strip of ebonite or other insulating material, so they move together; the two pivots P and N are connected to the positive and negative poles of the battery. B and C are the terminals of the primary coil; these are connected by the short wires as shown with the studs A and D. A short wire connects the studs A and K. When the levers of the switch rest on studs A and D the current will traverse the circuit by the path P, A, B, C, D, N. But when the ends of the levers rest on studs D and K the path of the current will be P, D, C,

B, A, K, N, or in an opposite direction to that of the first position.



I am of the opinion, however, that the advantage of a commutator is fully met by the greater complication involved. This, however, is only to be settled by an extended use for motor vehicle purposes, which is, of course, an altogether different thing from laboratory work with spark coils.

The subject of spark coils is fully treated in the works of Bonney, Bottone and others and dimensions of coils, capacity of the requisite batteries, etc., are easily obtained from their books. A word of caution may here be submitted, viz.: That the secondary wire should be somewhat thicker, say about two numbers, than is given in their tables. From their point of view length of spark is the desideratum, while on the contrary a short wide flash is preferable for ignition of gases. As an electrician would say, "A fatty spark is best."

The popular De Dion and Bouton engine has an ingenious combination of switch, cam, vibrator and speed regulator which is well worth noting in this connection. If reference is made to my Fig. 1, it is readily seen that if the vibrator is occasionally held away from the contact point G the current is broken and there is no need of the switch H except when stopping the machine for some time. In this motor the vibrator is mounted on an ebonite plate, which is on the side of the crank case, and which fits around the secondary shaft. This shaft carries on its end a disk having a notch cut in its rim. Against the circumference of the disk rests the vibrator, and when the shaft turns around the vibrator will drop into the notch and is free to oscillate back and forth until the cam rotates, the notch again raising the vibrator to its former place on the rim, and thus the current is again interrupted until a fresh working stroke of the piston shall be given. As the cam disk is permanently attached to the end of the shaft and the ebonite plate is capable of rotation about its axis, it follows that we can move the vibrator to some extent ahead of the notch or backward, if we choose. This would vary the time of the explosion and would thereby affect the speed as the operator should desire.

All wires should be attached so they can have little or no relative vibration; copper becomes brittle by bending and a break inside an insulated joint is not any too easily discerned; have tops of cells paraffined if acids are likely to creep; if possible use sealed or dry batteries; scrape well and solder all connections without acid flux; disconnect battery when engine is stopped, so that cells may recuperate; and I may lastly quote the editor of La France Automobile, who says:

"In short, assure yourself, above all things, that your source of electricity is ready to perform its duty; that the wires are intact; that the ignition plug is above criticism."

Beyond doubt much of the trouble with gasoline motors has been faulty ignition, and it has been in the hope of throwing some little light upon circumstances that may have contributed to such annoyances that I have treated the reply to Subscriber at unusual length.

R. I. CLEGG.

MINOR MENTION.

The Detroit Automobile Co., Detroit, Mich., expect to have vehicles on the streets about the middle of October.

The Benton Power and Traction Co., Sauk Rapids, Minn., has amended its charter so that it may own and rent electric carriages.

F. W. Lanchester, of Birmingham, England, inventor of the Lanchester oil motor, which is to be manufactured at Pittsburg, Pa., is now on his way to this country.

A manufacturer of Brussels, Belgium, is about to place on the market a dos-a-dos for four, propelled by a 20-h.p. motor and capable of a speed of 30 miles an hour.

J. G. & B. S. Ferguson, bakers, of Boston, Mass., are contemplating the change of their entire delivery service from horses to motors. They have an electric delivery already in use and a steam wagon is being built for them by E. S. Clark, of Dorchester.

At their recent annual meeting, Portland, Me., the directors of the Keating Wheel Co., Middletown, Conn., decided to change the name of the company to the Keating Wheel & Automobile Co. and to enter upon the manufacture of gasoline automobiles.

The Automobile Exchange, an emporium and training school, has been opened at 213 West Fifty-eighth Street, New York City. Vehicles propelled by the different motive powers will be kept in service and competent teachers and repairers will always be ready to instruct the novice or put vehicles in order. Courses will consist of five or ten lessons, and charge for vehicles and instruction will be made by the hour.

The United States Motor Vehicle Co., which was recently incorporated under New Jersey laws with a capital stock of \$1,500,000, have opened their office in the Townsend Building, Twenty-fifth St. and Broadway, New York. They will soon be ready with a line of gasoline and electric vehicles for both pleasure and business, and will also manufacture and sell to the trade marine and stationary engines. C. J. Field is vice-president and general manager.

A new departure in the style of the steam carriage made by the Locomobile Co. at Newton, Mass., will be carriages with regular phaeton tops, to meet the growing demand for a runabout or pleasure carriage that is not altogether open to the weather. The first carriage of this style was shipped a week ago to Philadelphia. The Locomobile Co. also has under construction a carriage after the pattern of the ordinary carry-all or beach wagon, with two seats, both facing front.

W. J. Staples, Maryville, Mo., has built a gasoline carriage and run it 500 miles satisfactorily. Belts are used for transmission from the motor shaft to the countershaft, tightened by a jockey pulley. A chain runs from the countershaft to the differential. Wood wheels, 36 and 32 in. respectively, are used—1¼ in. solid rubber tires and electric ignition. The maximum speed is 12 miles an hour. The carriages will, it is said, be placed on the market by the inventor and a local manufacturer.

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

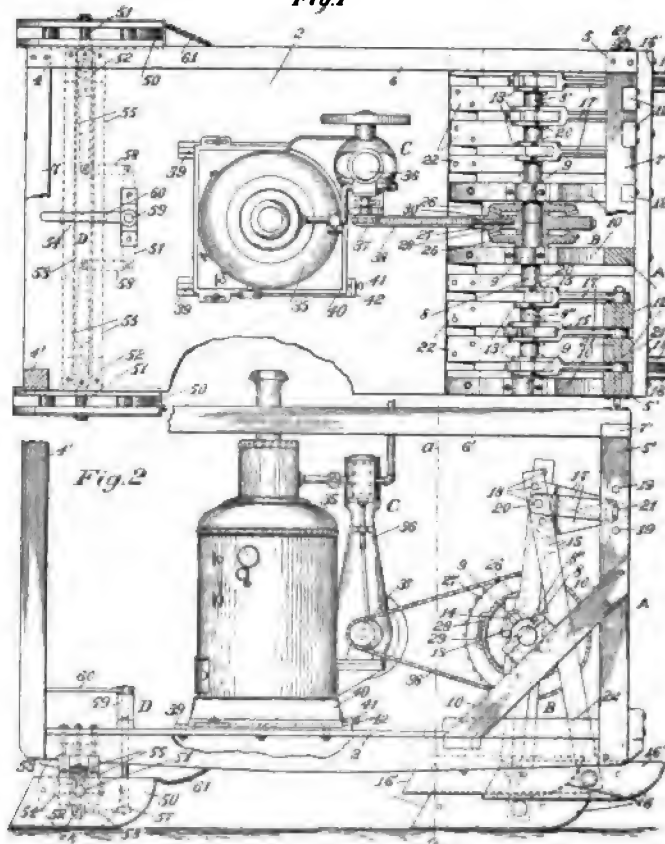
No. 633157—Motor Vehicle.—Francis H. Richards, Hartford, Conn. Application filed Oct. 30, 1897.

Fig. 1 is a plan view with parts broken away and in section, the rear part of said vehicle being shown as supported either by runners or wheels, the latter being shown in dotted lines. Fig. 5 is a transverse sectional view taken in line a a, Fig. 2, and looking toward the right in said figure. Fig. 6 is a diagrammatic view illustrating the operation of one of the drivers.

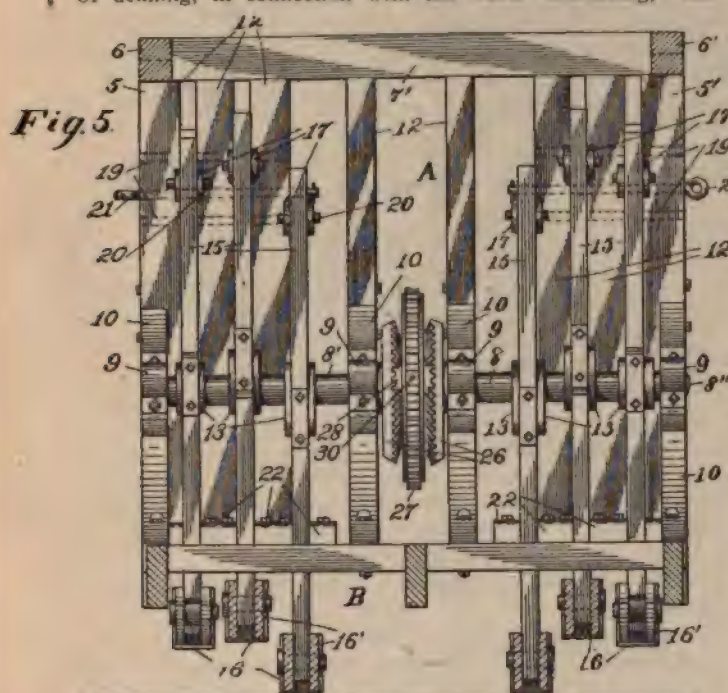
In the structure illustrated in the drawings this improved motor vehicle is shown organized for use as a sled or sledge, it being provided with supporting runners instead of driving wheels; but it will be understood that wheels could be used for supporting or carrying one part of the vehicle, if desired, in connection with this driving mechanism.

In a general way this improved motor vehicle comprises framework forming the body portion thereof (designated in a general way by A), driving mechanism therefor (designated in a general way by B), shown herein, comprising a series of drivers or propellers embodying runners having traversing and lifting movements or movements in elliptical paths, means

Fig. 1



such as motor mechanism (designated in a general way by C) for imparting motion to the driving mechanism, and means (designated in a general way by D) for guiding or steering the vehicle, and which in the present construction also constitutes the means for supporting or carrying one part of the vehicle. Since the drivers not only have traversing movements, but also upward and downward movements, in the description and claims the term "lifting" is used for the purpose of defining, in connection with the word "traversing," the



movements of these drivers, the term "lifting" being intended to include within its scope the upward and downward movements of the drivers.

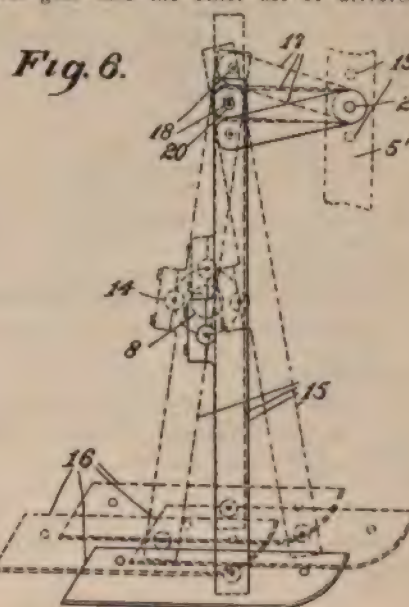
The framework or body of the vehicle comprises a suitable flooring 2, preferably supported by a series of longitudinally extending beams or bars. In the construction shown in the drawings this flooring is provided with a series of uprights, which are connected by longitudinal bars 6 and 6' and transverse bars 7 and 7'. The front end of the flooring is also shown provided with a series of upright members or bars 12 for the purpose hereinafter set forth, and which are secured at their upper ends to one of the transverse bars, as 7'.

The driving mechanism (designated generally by B) comprises a plurality of drivers or propellers, each of which comprises a runner and an upright walking beam, each supported for traversing and lifting movements, and means for imparting to the drivers such movements whereby each operates on one stroke to hold up and carry forward the vehicle and on the other stroke to move freely into position ready to begin another working stroke. In the construction shown in the drawings the vehicle is shown provided with two sets of drivers, each set preferably comprising a series of three drivers, such drivers being so disposed and operative that a pair of drivers, comprising one of each set, will operate substantially together to drive or propel the vehicle, while the drivers of each set operate in alternation, one to propel the vehicle while the others are moving into position to commence their working strokes. Any desired number of drivers may be used, but in practice it is deemed preferable to employ at least two sets, each set com-

prising a pair of drivers. For supporting these drivers a suitable crank shaft 8 is carried by the vehicle body. This crank shaft is shown herein as a duplex or two-part shaft, comprising two members or shafts 8' and 8'' in alignment with each other with their inner ends in juxtaposition, and which shafts are journaled in suitable bearings 9, preferably carried by four inclined braces 10, all secured at their lower ends to the vehicle flooring and at their opposite ends the outer two to the uprights 5 and 5' and the other two to a pair of the upright bars 12. In the present construction each of these crank shaft 8' and 8'' is shown provided with a series of three cranks 13, each for connection with a walking beam of its respective driver, the cranks of each shaft being disposed at different positions thereon, so that one driver of each set will always be substantially in working position to drive the vehicle. The positions of the cranks of one shaft correspond, in the present structure shown, with the positions of the cranks of the companion shaft, whereby the drivers will usually have their working strokes substantially together. Secured to each of these cranks by the crank pin 14 thereof is an upright walking beam 15, forming a part of the driver. Connected to the lower end of each of these walking beams 15, preferably by being pivotally secured thereto, is a runner 16, which is shown herein, comprising a pair of side members 16', suitably bolted together, the lower end of the walking beam projecting into and being overlapped by the side members. Each of these runners is provided with a shoe, such as an ordinary shoe, constructed of any suitable material and secured to the runner sides in any desired manner. These runners may be provided, if desired, with projections or spurs of any desired construction whereby they will not slip in use.

In order to change or vary the effective leverage of the drivers, mechanism is provided, which also constitutes a means for maintaining the drivers in their proper working positions. For rotating the crank shafts, gearing is provided, one part of which comprehends an equalizer, by means of which one set or a part of the drivers may continue in operation should another part of the drivers or the other set become temporarily inoperative through any cause, such as an impediment in the road, and which equalizer will also permit the stoppage of either set of drivers without injury thereto or breakage thereof and without injury to the other parts of the driving mechanism.

From the above it will be seen that should the working driver of one set meet with an impediment whereby it is prevented from operating, the rotation of the sprocket wheel 27 would not be retarded, as the pinion would then rotate and slip over the inoperative bevel gear and continue to operate the companion bevel gear and the other set of drivers. In other



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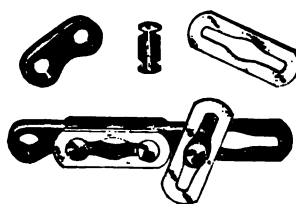
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